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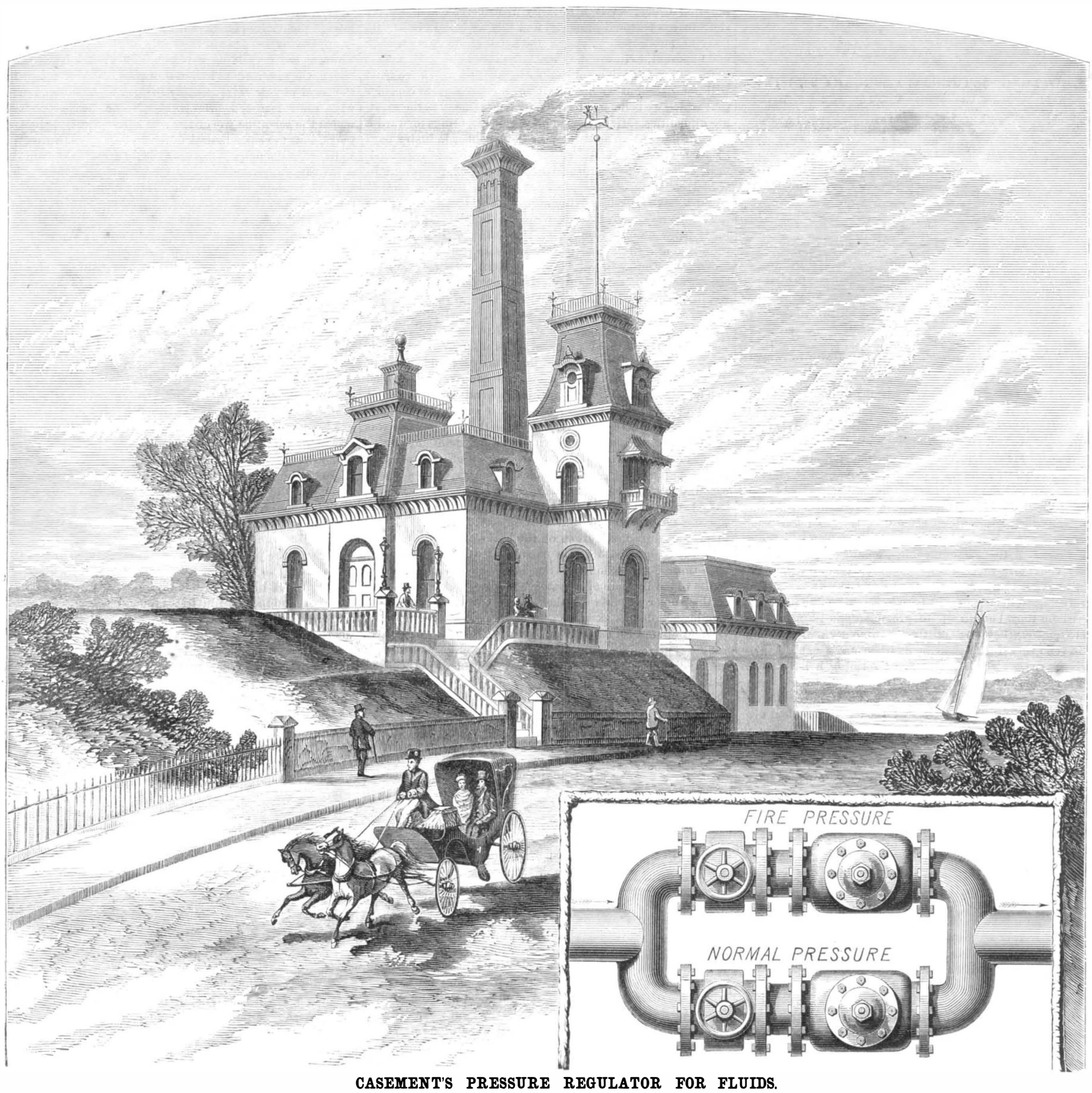

CASEMENT'S PRESSURE REGULATOR FOR FLUIDS.

CASEMENT'S PRESSURE REGULATOR FOR FLUIDS.

In describing the invention of which our illustrations depict the construction and principal applications, we deem it hardly necessary to prefix any extended prefatory remarks regarding the obvious utility of the type of apparatus to which it belongs. The advantages of a device by which a maximum and normal pressure may be reduced for ordinary continuous employment to any required low degree, while the full force is susceptible of instant utilization at any moment: or by which, from a single powerful source of supply, several deliveries may be effected, all varying in intensity: will, we think, be clearly apparent.

The points briefly enumerated above constitute the objects of the present device, and a reference to our illustrations will render plain the simple means by which the inventor secures them. Fig. 2, on page 134, shows in section the interior mechanism and modifications of the same are represented in the other engravings, of which due explanation will be made as we progress. A is the pipe which conducts the fluid from the source of supply, and represents the apparatus used by the inventor in conducting gas, from a natural gas well to his dwelling at Painesville, Ohio, for heating and illuminating purposes. Just above the orifice of pipe, A, is coupled a short section of tube, forming a chamber; and secured between the couplings by a flange and packing rings, is a truncated conical diaphragm, B. The latter it is proposed to make of hardened steel, and also as thin as possible, while securing the requisite strength, so that its upper aperture, which forms a seat for the valve, C, will be reduced as much as practicable to lessen the area subject to friction, and thus prevent any liability of the valve to stick. Valve, C, has a long stem which passes up through a guide, D. The upper portion of the chamber is closed by a screw plug, E, which can be readily removed to admit of access to the interior, and also for the purpose of placing in position the rings, F, of heavy metal, which serve to weight the valve.

We will suppose that the gas escapes from its source under the high pressure of 20 lbs., to the square inch, and that it is desired to distribute the same at a *constant pressure* of but one third of a pound. In such case, the weights on valve, C, would be adjusted to aggregate 19⅔ lbs. It is evident that, with this force acting in one way opposed to the greater one coming from the other direction, the amount of gas corresponding to the difference between the relative pressures would be that allowed to pass the valve: for should the pressure above the valve equal that below it, clearly gravity would bring the valve to its seat, closing the orifice and preventing further escape, until the pressure above once more became less than the force acting from below. Hence, by adjusting the weights, any degree of pressure in the distributing pipe may be maintained. The valve is, of course, automatic, and, as it is held suspended by the upward current, adjusts itself to the quantity of gas demanded, so that, as a moment's consideration will show, the sudden extinction of, say, twenty out of twenty-one burners cannot have the effect of causing the single one left to flare and sing; or, conversely, if an additional number of lights be started, the result is simply to decrease the pressure above the valve more rapidly, and allow of a quicker flow from below, which soon restores the proper equilibrium.

The gas, we have stated, passes under the conical valve, [illegible] escapes by the delivering main, G, depositing in its course any impurities which it may hold in suspension, which, naturally falling to the bottom of the chamber, between the walls of the latter and the diaphragm, B, are subsequently drawn off by the cock, H. The shape of the diaphragm and consequent loca-

[*For remainder, see page* 134.]

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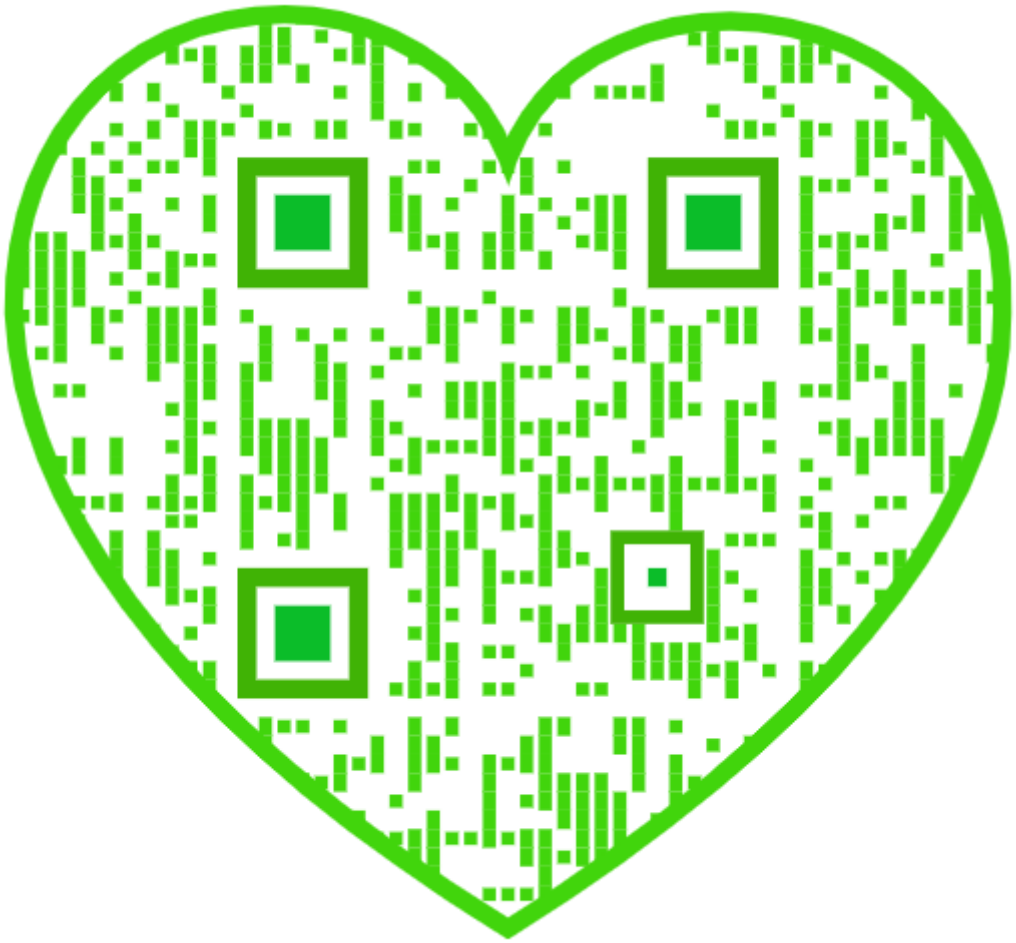

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PATENT MONOPOLIES IN CONGRESS.

Another of the overgrown monopolies, which not only oppress the people but retard the progress of industry in this country, is now before Congress attempting to induce that body to give it another lease of life. Some forty years ago, an American residing in England, invented a machine for forming felt hat bodies, which he subsequently brought to the United States for the purpose of patenting. Owing to an informality, his application was rejected; but some years afterwards, the right was granted to Mr. H. A. Wells, who presented the same machine, modified by one or two minor changes. Since 1846, the association owning this patent have held a complete monopoly of the business, and, by refusing to license others to use the machine (except a few whom they bought off to prevent opposition to their last extension), they force all the manufacturers of the country to send their fur to the ring factories to be manufactured at ring prices. The actual cost of forming a hat body is but two cents, and the charge is from six to twenty cents, showing the enormous profit of from two hundred to one thousand per cent on every hat of the ten million and over yearly produced in the United States. The actual loss to the hat makers over what the cost would be, if allowed to manufacture their own hat bodies, is estimated at over 42 per cent, and against this the trade can do nothing. If any dealer complains, the ring refuse to make his hats, and his business is ruined. Several years ago, Wells died, and since then, for the benefit of his "poor" widow, who has only made $111,000 out of the job thus far, two extensions were granted. Now, the ring comes before Congress again and asks for seven years longer, making thirty-five years in all in which to carry on their monopoly, and this in the face of the fact that the original form of machine patented by Wells, is not used and has not been for the past twenty-five years, but simply serves as a ground for litigation and the securing of damages for infringements. The hatters are resisting the attempt with all their influence, and they assert, that, with this oppressive tax abolished, they could not only produce more goods, and regain their lost foreign trade, but sell cheaper, and give their hands employment for the whole, instead, as is now the case, of only two thirds of the year.

These Wells patents, in common with those held by the sewing machine combination and the Woodbury planer ring, are infamous taxes on the people, and as such the country suffers for want of their abolition. We do not think the fault lies in our patent system, for the principles on which our laws are based are primarily the encouragement of the useful arts and the dissemination of knowledge concerning the same throughout the community. To foster their production upon the ground of expediency, and not of justice, limited monopolies are granted to the original and first discoverer, which, in accordance with the value of his invention, may yield him an ample remuneration for his thought and labor. Now if the inventor of a valuable article or process fails within a certain period to gain a just reward, then he may with justice be granted longer time; but if, on the other hand, he, or those representing him, succeed in obtaining a fair and adequate return during the lifetime of the patent, then there is clearly no reason for continuing the monopoly.

Mr. Sayler, of Indiana, has recently introduced a bill in the House of Representatives, the object of which is the suppression of the abuses we have pointed out, but the means taken are not such as will secure the desired result. It is provided that any article made under a single patent may be used, etc., by any one on payment of a royalty of 10 per cent on the market value, and that the user shall secure the patentee by a $10,000 bond, filed in the Patent Office. The royalty on patents for improvements, or on inventions covered by two or more patents, is to be fixed by the courts, and the same provision applies to copyrights. The trouble with this measure is that it strikes both ways; while benefiting the buyer, it injures the seller. It reduces the profits, perhaps, of the big corporations, but in like manner those of the smaller inventors whom it should protect. It puts into the hands of one man, the right to absorb the labor of another, carried on through years and at great expense, into a slightly improved device, giving the former individual all the profits, while the real worker must be content with a ten per cent royalty. Finally, apart from the crudity and ambiguity of its provisions (for on what basis is "market value," a fluctuating equivalent varying with locality, season, etc., to be estimated?), the law is open to the same objections as those relating to usury, as it arbitrarily restricts an individual's right to his personal property, and this we believe to be contrary to public policy, unless the need be imminent, clear and apparent, as in event of war.

We might urge other objections to the act—which we trust will not pass—but we dismiss it for the present to consider that which we believe to be the only true remedy to the existing difficulties. Mr. Sayler, in his argument, brings forward a mass of suggestive statistics; the india rubber industry pays 59 per cent on the capital employed, the cabinet organ business, 69 per cent, agricultural implements, 52 per cent. In seventeen months the capital invested in sewing machines doubles itself, besides paying all expenses; and finally comes the Wells hat manufacture, with the immense profits already pointed out. Now, with the full comprehension of these and other like cases: and there is no reason why a perfect understanding of the nature of these grinding *incubi* on the industries of this country should not be afforded us, for we, in common with other journals, have reverted to the matter again and again: why, we ask, do Mr. Sayler and his associates in Congress not strike directly at the roots of the evils and end them at once by refusing to extend their existences when the prescribed limits are reached? This hat body outrage has been fastened on the country for the last seven years by an innocent looking amendment tacked on the end of a bill on the last night of a session. Members failed to investigate, the measure passed, and the work was done. In other instances which we might mention, wealth is unsparingly used, opposition is bought off, professional talent employed, "poor" widows brought out as figure heads, Congressmen coaxed and cajoled, if not bribed, and, in fact, every art and trick of the lobby practised to ensure the passage of a desired bill—the object of which is simply to impose additional burden on the backs of the people.

The remedy needed is an enactment which will do away with these Congressional extensions, which will fix certain limits to the lifetime of a patent, subject to the discretion of the proper officials in the Patent Office. These limits should include one extension, to be acceded after careful investigation and for cause; but beyond the period so granted, not a day should be allowed. During twenty-one years, if the invention be of value, abundant remuneration can be gained; and monopolies of half a century's standing should be effectually abolished and rendered impossible.

SLIPPERY PAVEMENTS.

It takes but a short stroll along Broadway, during winter time, to convince one that, excellent as the Belgian pavement is in many respects, it nevertheless becomes, when well worn down by use and when covered with snow or ice or even with thin mud, a prolific cause of falls and injury to the heavily burdened horses constantly traveling over it. We know of no statistics which will show the average yearly amount lost through animals thus becoming maimed; but judging from our own observation and from the isolated fact that, quite recently, in passing once up and down Broadway on a single frosty day, we counted fifteen falls and four horses left by the roadside to die, it may be imagined that the aggregate must reach a considerable figure. The street, at times, becomes dangerous even to pedestrians in crossing, and hence doubly perilous for the horses from the insecure footing of their metal shoes. It would seem that the wooden pavements now on many of the side streets in this city, offer great advantages in point of security over roads of stone; but experience has so proved the unsuitability of the former, to meet the requirements of a street constantly alive with a heavy traffic, that their use on such thoroughfares as Broadway is practically out of the question. The subject is one to which we think the attention of inventors might be profitably turned, and a substantial pavement, combining the durability of stone with the supporting capability of wood, produced. In this connection, we notice that an investigation has been conducted in England, by Mr. William Haywood, engineer and surveyor to the Commissioners of Sewers of the city of London, which mainly consisted in observations as to the number of accidents befalling horses on asphalt, wood, and granite pavements. The investigations extended over fifty working days, and were principally made during the rainy weather of spring. The granite was found to be most slippery, the asphalt next so, and the wood the least. Considered in respect to moisture, asphalt was most slippery when merely damp, and safest when dry; granite most slippery when dry, and safest when wet; wood most slippery when damp and safest when dry. Wood, on the whole, is less slippery than either asphalt or granite in a marked degree, it being only inferior to granite when the pavements were wet, and the difference then between the wood and the granite being considerable. Of the accidents most obstructive to traffic, as well as most injurious to horses, asphalt had the greatest proportion, granite next, and wood least.

HERSCHEL, TYNDALL, AND DRAPER ON THE SUN RAY

Studying the solar spectrum, about the beginning of the present century, the elder Herschel passed a sensitive thermometer through the successive colors and observed that the greatest heating effect was not at all coincident with the brightest illumination. At the violet end of the spectrum, the heat was scarcely apparent. As the thermometer passed toward the red, the temperature slowly increased, the maximum appearing sometimes in the red, sometimes at a distance beyond the red, where no rays were visible.

The inference which he drew from these observations was that the heating rays were separate and distinct from the luminous rays and of a lower refrangibility. By the use of photographic papers, it was subsequently ascertained that the chemical action of the sun ray appeared to be greater toward the violet end of the spectrum, the maximum power apparently residing in the violet or ultra-violet radiations. Thus, as the rays of high refrangibility diminished in brilliancy, they seemed to increase in chemical power, much as the rays of low refrangibility increased in heating power with their lessened brightness. Hence arose the belief, which the scientific world has generally entertained of late years, that the solar radiation was triple in constitution, and so likewise the emanations from other self-luminous bodies. A favorite illustration of this view has been a cable woven of three strands, which were regarded as being separated by the prism into three independent yet slightly overlapping spectra: a visible spectrum culminating in the yellow; a heat spectrum at the red end and beyond the red; and a chemical spectrum chiefly in and beyond the violet.

In the spectrum produced by a prism of flint glass and prisms of highly refracting gems, the greatest heat was found below the red; with a crown glass prism it was associated with the pale red; with a prism filled with alcohol it appeared in the orange; while a prism of water gathered the heat chiefly in the yellow. Yet in spite of the evident connection which these facts would seem to point out between the position of the heat spectrum, so called, and the nature of the prism employed, no attention was paid to the suggestion, made by Dr. Draper as early as 1844, that the phenomena observed must be due not to any inherent property of the sun ray but to the prism, which crowded together the rays of the red end of the spectrum and greatly dispersed those of the blue and violet portion. In other words, the red end of the spectrum is warmest as the earth is warmest at the equator, not because the heat rays tend chiefly to that region, but because a greater number of solar emanations fall upon a given area there.

Perhaps the person who has been most influential in giving currency to Herschel's error is Professor Tyndall. In the eighth of his classic lectures on "Heat, considered as a Mode of Motion," he illustrates the subject with characteristic force and felicity. Using the thermo-electric apparatus devised by Melloni, he brings to bear upon the face of the pile the spectrum of electric light passed through a prism of bisulphide of carbon, and says: "I turn the handle and the slit gradually approaches the violet end of the spectrum; the violet light now falls upon the slit, but the needle does not move sensibly. I pass on to the indigo, the needle is still quiescent; the blue also shows no action. I pass on to the green, the needle barely stirs; now the yellow falls upon the slit; the motion of the needle is now, perhaps, for the first time visible to you; but the deflection is small, though I now expose the pile to the most luminous part of the spectrum. I will now pass on to the orange, which is less luminous than the yellow, but you observe, though the light diminishes, the heat increases; the needle moves still farther. I pass on to the red, which is still less luminous than the orange, and you see that I here obtain the greatest thermal power exhibited by any of the visible portions of the spectrum. The appearance, however, of this burning red might lead you to suppose it natural for such a color to be hotter than any of the others. But now pay attention. I will cause my slit to pass entirely out of the spectrum, quite beyond the extreme red. Look to the galvanometer; the needle goes promptly up to the stops. So that we have here a heat spectrum which we cannot see, and whose thermal power is far greater than that of any visible part of the spectrum. In fact, the electric light with which we deal emits an infinity of rays which are converged by our lens, refracted by our prism, which form the prolongation of our spectrum, but which are utterly incompetent to excite the optic nerve to vision. It is the same with the sun."

Subsequently Professor Tyndall, by means of a prism of rock salt, determined a heat curve in the region of the dark rays below the red, which, as he expresses it, "suddenly shoots upwards in a steep and massive peak, a kind of Matterhorn of heat, which quite dwarfs by its magnitude the portion of the diagram which represented the visible radiation." The same teaching was represented in the American lectures, the "Matterhorn" diagram occupying page 148 of Appleton's edition of the lectures. These lectures, it will be remembered, were delivered many times among us during the winter of 1872-3.

In the month of August, 1872, Dr. Draper published, in the leading scientific periodical of Great Britain, a memoir (a digest of which was shortly after given in the SCIENTIFIC AMERICAN) on the distribution of heat in the spectrum, in which he not only repeated his belief that the method employed by Herschel and subsequent investigators must necessarily lead to incorrect results, but furnished an overwhelming array of observations disproving them. As for Professor Tyndall's estimate of the proportions of heat on the two sides of the "extreme red," he held that "they were valueless for lack of care in determining the point of division." The red light shades off gradually, so that it is almost

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impossible to tell where it really comes to an end. "A linear thermopile, such as is commonly used, is liable under these circumstances to give deceptive results; and any error in its indications counts in a double manner; it not only diminishes the value of one spectrum, but adds that diminution to the value of the other." Thus an error of only two millimeters in estimating the position of the extreme red would have taken so much from the invisible and added it to the visible that the two would be brought to an equality; then the slightest turn of the screw, that carried the pile toward the dark space, would have given a preponderance to the visible. "It is obvious, therefore, that there cannot be certainty in such measures unless fixed lines are resorted to as standard points."

This done, the destruction of Tyndall's position is complete. The optical center of the spectrum is the ray which, according to Angstrom's determinations, has the wave length of 5,768. Now if the rays on two sides of this line be brought to seperate foci and their thermal effects carefully measured, it is obvious that any excess of heat at either end of the spectrum will be speedily detected. By an ingenious apparatus described at length in the memoir, Dr. Draper did so compare the heating power of all the less refragible rays with that of all the more refrangible, using prisms of various material, and making some hundreds of observations on an unclouded sun. Taking 100 as the standard for the heating power of the entire spectrum, the mean of four sets of measures, with a prism of rock salt, gave 53 for the heat of the more refrangible region, and 47 for the less refrangible. Another series of three sets gave for the two regions 51 against 49. With a prism of flint glass, two series, one of ten sets of measures and the other of eight, gave respectively 49 to 51 and 52 to 48. Two series of the same number of experiments with a prism of bisulphide of carbon gave 52 to 48, and 49 to 51, respectively for the more refrangible and the less refrangible rays. With a quartz prism, twenty-seven experiments gave 49 to 51; while another set of twelve gave 53 as the mean for the more refrangible and 47 for the less. These are given as fair examples of results obtained by a multitude of experiments during several months, including winter and summer. The heating powers of the two halves of the spectrum show such close correspondence that we may safely follow Dr. Draper's lead and impute the differences to errors of experimentation.

The second memoir on chemical action of the spectrum, published in December, 1872, proves even conclusively that every part of the spectrum, no matter what its refrangibility may be, can produce chemical changes: and that the "actinic curve," so-called, does not represent any peculiarities of the spectrum, but simply the habitudes of certain compounds of silver. As a logical consequence, the supposed triple constitution of the sun ray must be dropped among the myriad other dead delusions that mark the onward course of Science, as the skulls of perished camels mark the course of a caravan. There is in the sun ray neither light nor heat nor chemical power, as such, but simply vibrations, which, when stopped, may manifest themselves in one or other or all of these phases of phenomena according to the nature of the extinguishing substance. "The evolution of heat, the sensation of light, the production of chemical changes, are merely effects, manifestations of the motions imparted to ponderable atoms."

It was a matter of surprise to many that, during his lectures here, Professor Tyndall did not so much as mention these important researches, not even to question the justness of Dr. Draper's conclusions. It is perhaps still more surprising that he has since as carefully refrained from publicly discussing them, yet still continues to teach the old doctrine.

It would be asking too much, perhaps, to expect Professor Tyndall to reconsider his subject in the face of the numerous and imperative engagements, that had been made for him here, but surely time enough has since elapsed to allow him to do so. The omission of any reference to Dr. Draper's later work, even in a foot note in the edition of the lectures published by the Appletons, might be excused for the same reason. But what can we think, when the English reprint retains the old teachings without the suggestion of a doubt in regard to their correctness? To put it in the mildest form, it places Professor Tyndall in a slightly equivocal position for one who boasts himself an unprejudiced seeker after truth, for the truth's sake.

It is reported that, when his attention was called to Dr. Draper's researches, Professor Tyndall—repeating his favorite Alpine figure—said that his investigations had raised such a Matterhorn of heat at the red end of the spectrum that it was impossible to get over it, short of a year at least. The year has passed; is there still a Matterhorn of pride to be surmounted?

WHITWORTH STEEL.

Sir Joseph Whitworth has recently published a valuable work, in which he gives an exhaustive account of his method of casting and rifling steel guns. It will be remembered that, some time ago, we published an account of the remarkable performances of the nine pounder cannon of the above inventor, and also referred to the crucial test caused by the explosion of 1½ lbs. of powder in a cylinder of fluid compressed steel, in which no other opening was left save that of the vent. The cylinder was a copy of the breech of the nine pounder gun, and it was estimated that the strain would be six times greater than if the shot were allowed to leave the piece. The projectile was screwed in, and the charge fired. Although all the gas escaped through the vent, which was thereby enlarged from one to two tenths of an inch, no alteration could be detected in the external or internal dimensions of the cylinder.

In explaining the nature of his steel, the author states that it is impossible to cast a large gun of highly carbonized steel that can be relied upon as perfectly sound. With a small amount of carbon in its composition, however, the metal becomes so ductile that it will elongate under pressure from 30 to 50 per cent before breaking, and then will not fly in pieces, but only bulge and tear. To obviate the defect of honeycombing in steel of this description, recourse was had to extreme pressure upon the metal while in a fluid state, equal in some cases to twenty tuns per square inch. As a measure of the quantity of air expelled by this process and the consequent improvement in density and soundness, it is stated that, within five minutes after the application of pressure, the fluid column will be shortened by an inch and a half per foot of length; and drawing out and forging developes, in a still higher degree, the strength of the material. It is cast in hollow cylinders, for reasons connected with rapid cooling and the more complete exclusion of air, and is manufactured in thirteen qualities, ranging from a tensile strength of 40 tuns per square inch to one of 72 tuns, the ductility at the two extremes being respectively 32 and 14 per cent.

The invention is of the highest importance, not only in its application to weapons of war, but to the more useful implements of peace. For steam boilers and railroad axles, it would seem that steel of such extreme strength must be invaluable.

A PAPER AND GLASS DEBATE.

A correspondent sends us a couple of interesting questions, which, he informs us, are to be the subject of a debate, relating to the merits of paper and glass. The first is: "Providing we had no paper, what other substances may be mentioned that would take its place?" and the second, "Providing we had no glass, what are its possible substitutes?" Of course the idea is to bring out, in the present connection, not names of substances which may be advantageously used instead of the above named almost indispensable materials, but of such as we probably would employ (and of many of which in fact our ancestors did avail themselves) did glass or paper cease to exist or become unattainable. The case is imaginary but leads to much instructive thought.

In lieu of glass, we can find materials suitable for window panes, for drinking vessels, and in some cases even superior to it for small lenses, but nothing that combines all its properties, or is capable of its ready manipulation into desired forms. For windows, perhaps the best substance other than glass is simple mica, which may be readily split from the rock in thin translucent sheets. It is now used for doors of stoves, to protect paper shades around gas lights, and in other common employments. The Romans filled their windows with *lapis specularis*, a fossil of the class of mica, which is readily cloven into thin smooth laminæ. The same substance is found in the Island of Cyprus, in masses a foot in breadth and three inches in thickness. It is used for the construction of hot houses, and for the protection of delicate plants. Up to the present day it is also much employed in Russia, in place of glass for windows.

Horn cut into sheets is still used for lanterns, and for drinking vessels, and, if made sufficiently thin, would answer for illuminating purposes. Oiled linen or other fabric, similar to that now used by draftsmen for tracing, would also be available, and so would very delicate sheets of india rubber. Skins, prepared like parchment or vellum, would be translucent though not transparent. Gelatin, however, might be treated with bichromate of potash so as to be insoluble, and if it would stand the weather would give quite clear window lights. Collodion films, we should imagine, if made thick enough, could also be used for the purpose, as also animal membrane.

In addition of mica, the mineral kingdom offers a variety of substances. There is the Brazilian pebble, a species of quartz, now used in an immense extent for spectacles and other lenses. We have seen perfect spheres of this material three inches in diameter, without a single speck or flaw to blemish its complete transparency. Rock crystal and other varieties of quartz might also be employed, if means could devised to cut them properly; so could plates of selenite, of thin alabaster, or even of rock salt, though the latter would not be very durable. Some shells are sufficiently thin to be translucent, and ivory could be made into plates having the same property. Amber would be transparent enough but difficult to obtain while, like ivory it would be rather costly. Large leaves of trees, if chemically treated, might have their texture preserved and serve to cover windows if other means failed; or if the dwelling were located in polar latitudes, one might follow the example of the Esquimaux and use blocks of clear ice.

In recalling substitutes for paper, many of the materials, suggested in place of glass owing to their translucency, would, from their flexible nature, answer even more suitably for writing purposes. Such is evidently the case with parchment, membrane, cloth, horn, rubber, collodion, or gelatin sheets. We might go back to graven tablets, like the Moabite stone, or write with the stylus upon wax, as did the ancients; in fact, there are numberless modes of inscribing our thoughts on solid substances. But paper has a multitude of other uses, especially in these days of paper clothing, paper furniture, paper churches, and paper money. Hence materials are needed with more of its attributes than simply its use as a vehicle for the dissemination of our ideas. The same source of supply, open thousands of years ago, is still at hand, for the papyrus tree flourishes yet in Egypt and Sicily. The bark of the common white birch may also be employed; or by ingenious machines we can cut shavings of fine grained wood to serve in place of hangings for our walls. Sheets of metal, rolled to almost infinite attenuation, would, however, probably form the most favored substitute. About two years ago the Upper Forest Tin Works, in Wales, rolled the most delicate sheet of iron ever made. The metal was worked in a finery with charcoal and the usual blast, then forged into a bar, and finally passed through the tin rolling mills. When finished, the sheet was 10 inches by 5½ inches in dimensions or 55 inches in surface, and weighed but 20 grains. It would require 4,800 such layers to make up a mass one inch in thickness. Letters have been sent across the Atlantic on iron thinner than ordinary paper, and nearly as light. Steel, iron, and copper could thus be pressed into service; and where flexibility was necessary, probably alloys could be made to answer the purpose.

SCIENTIFIC AND PRACTICAL INFORMATION.

A TEST OF THE AUTOMATIC TELEGRAPH.

A public test of the automatic system of telegraphy recently took place on a single wire between this city and Washington. The matter transmitted was the President's late message, with the Spanish protocol attached, numbering 11,130 words, it having been selected in consequence of the declaration that its transmission over eight wires by the Western Union Company, on December 2, 1873, was a fact unparalleled in telegraphy.

The President of the Automatic Telegraph Company submits a report, which is corroborated by the testimonials of various well known gentlemen who witnessed the trial, to the effect that the entire document was copied complete in New York in 58 minutes from the time of the beginning of the sending in Washington. Ten perforators, thirteen copyists, and two Morse operators were employed, as against sixteen expert Morse operators by the Western Union people. The average pay of perforators and copyists is $40 per month; of operators, $100.

A NEW ACOUSTIC PYROMETER.

It will be remembered that, some time ago, we gave an account of an acoustic pyrometer, devised by Professor Mayer, of the Stevens Institute. The principle on which the instrument is based is the variation of the length of a sonorous wave in air, when the temperature of the latter is changed.

Mr. Chautard states, in *Les Mondes*, that in his opinion the method proposed by Dr. Mayer is difficult in application, and he suggests the following arrangement as more suitable for practical requirements:

The sound is produced by the aid of an organ tube, Ut 4, for example, disposed with reference to a resonator which is put in relation with the two branches of a König improved interference apparatus. To the movable branch is attached a long tube of copper, which enters the furnace or other locality, the temperature of which it is desired to determine. This tube returns on itself and communicates with a small manometric capsule. The fixed branch of the apparatus is terminated by another capsule, which, like the first, is in relation with the same source of heat. The arrangement is completed by a revolving mirror, in which the state of the flame is seen.

Thus disposed, if the pipes which separate the resonator from the capsules each contain an equal number of half wave lengths, the flame will be edentulated; in the contrary case, the indentations will diminish, and this as much more as the difference of length of the tubes is more nearly equal to an unequal number of half wave lengths. In the latter event, the flame takes, in the mirror, the aspect of a ribbon; and by noting the changes in its appearance the calorific state of the air in the tube in the furnace is determined. If the temperature is elevated, the length of wave augments, and a clearly defined interference is shown by the flame in the mirror. If, during the continuance of the experiment, the movable tube be gradually elongated, it will be easy to bring the flame back to its primitive state, that is, to cause the indentations to re-appear. Then, by the aid of a scale previously determined and empirically translated into thermometric degrees, the degree of temperature in the tube can be easily noted.

TO NEW SUBSCRIBERS.

All subscriptions to the SCIENTIFIC AMERICAN will be commenced with the year, unless persons, at the time of remitting, request to the contrary. Nearly all subscribers preserve their numbers for binding; and in most cases where subscriptions are received during the first quarter of the year, if the back numbers are not sent, they are subsequently ordered. To save both the subscribers and ourselves trouble, the back numbers from January 1 will be forwarded, unless we are advised to the contrary. This course will be pursued till April 1, after which date the paper will be sent from the time of receipt of remittance; but subscription. may commence at any time, at the request of the subscriber, The above regulation applies only to those who give no instructions, at the time of remitting, as to when they desire to commence.

G. D. says: "I think there is a great deal of humbug about the Troy chainmakers, in the paragraph from the Troy *Times*. Any good smith can make chain, and England is full of them; they would be glad to get one half of the wages mentioned."

A CORRESPONDENT, O. A. O., reports that in Sebastopol, Cal., from November 1, 1873, to January 14, 1874, the enormous quantity of 33 inches of water fell, in the form of rain and snow.

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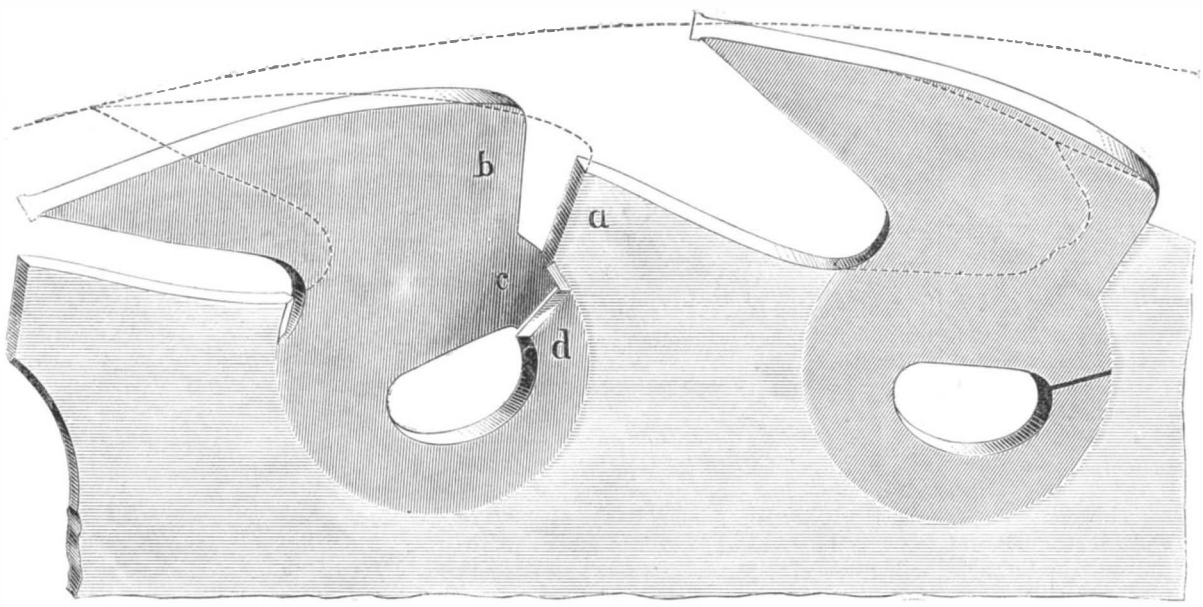
IMPROVED MOVABLE TEETH FOR SAWS.

The novelty of this invention consists, first, in punching out only the central part of the lower half of the circular shanks, then cutting off the remaining segment at *d*; it is thus rendered elastic, and may be sprung laterally, so that the V on the inner edge of the socket may enter into the corresponding groove cut in the edge of the shank, as shown in the tooth at the left hand of the engraving. It will be seen that, if the said tooth were turned in the direction to elevate the point, the circular shank would be rolled out of the socket, the butt of the tooth, *c*, passing to the opposite side of the plate; also, were the point turned down so that the butt, *c*, would pass the shoulder, *a*, then the butt, *c*, would spring into line with the plate; then the tooth must be struck on the back, at *b*, light successive blows with a hammer, until the shoulders meet. To remove a tooth from or to insert it into a socket, the corresponding movements must, of course, be made; and to effect the object, a common hammer only is required. The shanks are milled to the size of the sockets and given a spring temper; the tooth is next laid on an anvil and struck with a hammer on the side and near the inner circle, so as to open the space where it has been cut, at *d*, and make the shank larger than the socket. The segment or spring of the shank is left just strong enough to cause the necessary friction to hold the tooth firmly in position, and it readily conforms to the size of the socket, always making a perfect fit when turned into place.



IMPROVED MOVABLE TEETH FOR SAWS.

Some of the advantages claimed for this new mode of construction are: A more perfect interchange of teeth; being so strong and stiff, the saw will be the same in every respect as a saw with solid teeth; and the saws afford twice as much stock for wear, as those heretofore made, and are said to be fifty per cent cheaper to the consumer.

Patented in the United States and Canada through the Scientific American Patent Agency, by W. P. Miller.

For further particulars address R. Hoe & Co., 29 and 31 Gold street, New York city.

HILF'S IRON PERMANENT WAY.

We extract from *Engineering* the annexed illustrations of a system of iron permanent way, recently designed and introduced on the Nassau State Railway, in Germany, by Mr. Hilf. About 65 miles of line have been laid, and we understand that the cost of maintenance has been scarcely one third of that for ordinary permanent way. The invention consists in iron longitudinal sleepers to which the rails are secured, the gage being maintained by the bolts passing through the web of rails. The latter, shown in section in our engravings, are of Bessemer steel, and for the Nassau railways were made in lengths of 19 feet 8¼ inches each, weighing 48 lbs. to the yard.

The mode of fastening rails and sleepers is clearly represented in Fig. 1. The former are notched only at the ends and are secured by a bolt, *a*, placed on one side to avoid longitudinal displacement. *b* is the tie rod, two of which per length of rail are used. The entire structure weighs 232·64 lbs. per yard, and its entire cost, in Europe, is estimated at about $7.50 per similar distance. In Fig. 2 is represented the drainage adopted in connection with the system. A peculiar arrangement of switch is employed, the characteristic of which is that the center is not between the two lines of rails, but within the line, so that two frogs are saved.

The combination is such that a train may pass from one line to the other in either direction, or, by another setting of the points, may remain on the same rails.

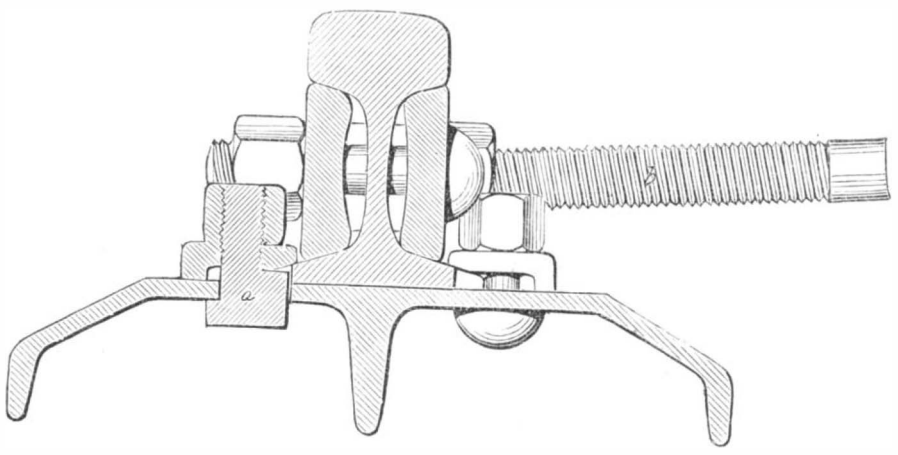


Fig. 1.—HILF'S IRON PERMANENT WAY.

Oil Notes.

Apropos of oil, especially petroleum, the following facts gleaned from the pages of the *National Oil Journal*, are quite novel and of considerable interest:

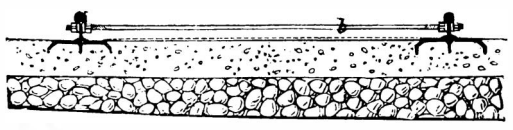
There have been several articles going the rounds of the press, strongly recommending, to farmers and others, the use of crude petroleum as a cure for the grub or borer. It is suggested to apply the oil with a brush to the trunk or bark of a tree. To this our contemporary registers a very strong objection; and while admitting that petroleum is useful for burns, scalds, corns, sore throat, consumption, fleas, bed bugs, and as a cockroach exterminator, he remarks that there is a point where the utility of the product ends, and that is just before it is rubbed on fruit trees. The editor has tried it, and finds that every leaf is killed in a single day, while there is little doubt but that the same result would follow the application to the bark.

Some time since, we referred to a number of compounds sold throughout the country as non-explosive oils, but which really were very dangerous, and of course a fraud on the public. A curious record of nostrums is also to be found among recent English patents; and among a list of seven of these mixtures, the following are specimens of ingredients to be added, to prevent explosion: Cascarilla bark, Iceland moss, alkanet root, camphor, potatoes, sulphur, iron rust, gum olibanum, sal soda, and onions. These articles are added in very small amounts to very large quantities of gasoline or naphtha.

It is hardly needful to remark that they merely act as impurities, and disguise the odor of the burning fluid, while of course the chances of explosion are not in the least diminished. No oil, which at low temperature will give off the vapor which, mixing with a proper proportion of air, causes explosion, is safe, no matter how much sulphur, potatoes, or other useless matter be added.

As an exemplification of the sudden rise and equally abrupt fall of some of the towns, or rather cities, which sprung up in the oil regions when the petroleum fever agitated the country, our contemporary says (on the authority of another journal that we never heard of) that the famous and at one time popular hotel, the Danforth House, Pithole City, which cost twenty-eight thousand dollars, was sold recently for a ten dollar note, and the furniture, which cost three thousand dollars, brought less than ninety. Within one month from the completion of the first house, Pithole city had an eighty thousand dollar hotel. In two months she had a daily paper, and a fast one it was too. In three months she had a theater. That theatre went to Pleasantville, thence to Lawrenceburg, thence to Parker's Landing, thence to where the woodbine twineth, in the second great fire at the landing last winter. In four months she had another theater and an academy of music. In five months she had her celebrated mud fire extinguisher, a curious invention for throwing mud. In six months she had seventy-four hotels and boarding houses, where the substitute for water was dispensed. In seven months the Miller farm pipe line was completed, which event threw four thousand men and two thousand horses out of employment, and Pithole city had reached the zenith of her glory. She had at that time fifteen thousand inhabitants, elaborate water works, and all the paraphernalia of a city government. She has now no theater, no hotel, no telegraph office (the telegraph office was closed for time and eternity last week), and but nine families out of all that multitude. The Pithole and Oleopolis Railroad runs but one train of one car a day, and that only to hold the charter.

Fig. 2.



In the way of statistics, we note that the total quantity of petroleum, exported from the United States in 1873, reached 236,899,223 gallons, showing an increase from 80,000,000 to 95,000,000 gallons over the three preceding years; also that the average daily product of the Pennsylvania oil regions, from the discovery of petroleum to November 1, 1873, was 10,753 barrels, and the total aggregate for that period 13,385,589 barrels.

Dental Amalgams.

It is the general practice to combine the alloy with an excess of mercury, afterwards squeezing out the surplus mercury with the fingers or a pair of pliers.

As it is impossible to get rid of the mercury by this operation, since about twice the necessary quantity remains, leaving the amalgam hard and unworkable, the only proper course is to use the exact proportion necessary to the combination. Should a surplus of mercury at any time be found on the surface of an amalgam filling, when the packing is finished, it can be tolerably well absorbed by slices of crystal gold, cut thin with a razor and laid upon the dry surface of the filling, until they are white with the mercury, when they are removed.

Now, if chemically pure silver and tin be combined in atomic proportions, silver 108, tin 118, twenty-four grains of the clean filings, mixed with seven grains of mercury, will result in a powder, adhesive under pressure, which will not dissolve in alcohol, and therefore needs no washing, and which will weld up as solid as a coin. This is a true amalgam, containing no free mercury, in fact there is great difficulty in separating a trace of mercury below a red heat. But, of course, it is impossible to use a powder in the majority of cases.

But there is a filling which it is practicable to use in almost all circumstances, namely, the ordinary silver and tin amalgam mentioned above, with the addition of ten per cent of fine gold and sufficient platinum to insure rapid setting. If to twelve grains of alloy four or five grains of mercury be added, and the resulting compound be carefully packed, without washing, into the cavity, little by little, with small points, warmed, if necessary, and finished up by repeated burnishing, the result will be a more perfect filling than can be procured by ordinary means, and that, too, with a compound containing little or no free mercury.—*Dental Miscellany.*

Idleness.

Many young people think that an idle life must be a pleasant one; but there are none who enjoy so little, and are such burdens to themselves, as those who have nothing to do. Those who are obliged to work hard all day enjoy their short periods of rest and recreation so much, that they are apt to think if their whole lives were spent in rest and recreation, it would be the most pleasant of all. But this is a sad mistake, as they would soon find out if they made a trial of the life they think so agreeable. One who is never busy can never enjoy rest; for rest implies a relief from previous labor; and if our whole time were spent in amusing ourselves, we should find it more wearisome than the hardest day's work. Recreation is only valuable as it unbends us; the idle can know nothing of it. Many people leave off business and settle down to a life of enjoyment; but they generally find that they are not nearly so happy as they were before, and they are often glad to return to their old occupations to escape the miseries of indolence.—*Herald of Health.*

Where to Buy Sporting Tackle.

Mr. Walter C. Hodgkiss, late of Cooper, Harris, and Hodgkiss, of this city, a firm noted for its sale of guns, revolvers, and articles for sportsmen's use, has recently withdrawn from that concern, and assumed business on his own account, at No. 7 Warren street, New York. Mr. Hodgkiss offers an exceptionally excellent assortment of the goods above named, and we would suggest the inspection of his stock, to all desirous of supplying themselves with the newest and best improvements in hunting implements and supplies.

J. E. E., of Pa., writes to say that recently, in a church at Alleghany City, Pa,, a crowded congregation were warned by the pastor that the services could not be continued, and they retired quietly and in good order. The church was on fire in the roof; and had it not been for the presence of mind of the minister, and of the sexton who discovered the fire, the consequences might have been terribly fatal. Such self-command deserves the highest commendation.

Mr. H. Crosby writes to point out that the easiest way to describe a heptagon in a circle is to take half the chord of the arc of 120°, which is equal to a side of the required figure. This is correct, and will be of practical use.

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PIPE CUTTING AND THREADING MACHINE.

The slow and tedious process of cutting and threading wrought iron pipe with the tools now used, together with the great waste of material and the imperfect work produced (except with expensive and cumbersome machines), have long been causes of complaint among steam and gas fitters.

Our illustration represents a machine claimed to have the same capacity as more costly stationary machines, with the great advantage of compactness and portability, weighing but one hundred pounds, occupying a space of 15x17 inches only, and so constructed that a boy can thread, cut, or make nipples from pipe, as large as 2 inches diameter, with perfect ease.

Fig. 1 shows the machine as fitted for hand power, motion being transmitted to the several parts by means of gearing, as shown; while on the extreme left is seen the pipe, A, held stationary by the adjustable jaws of the pipe vise, B.

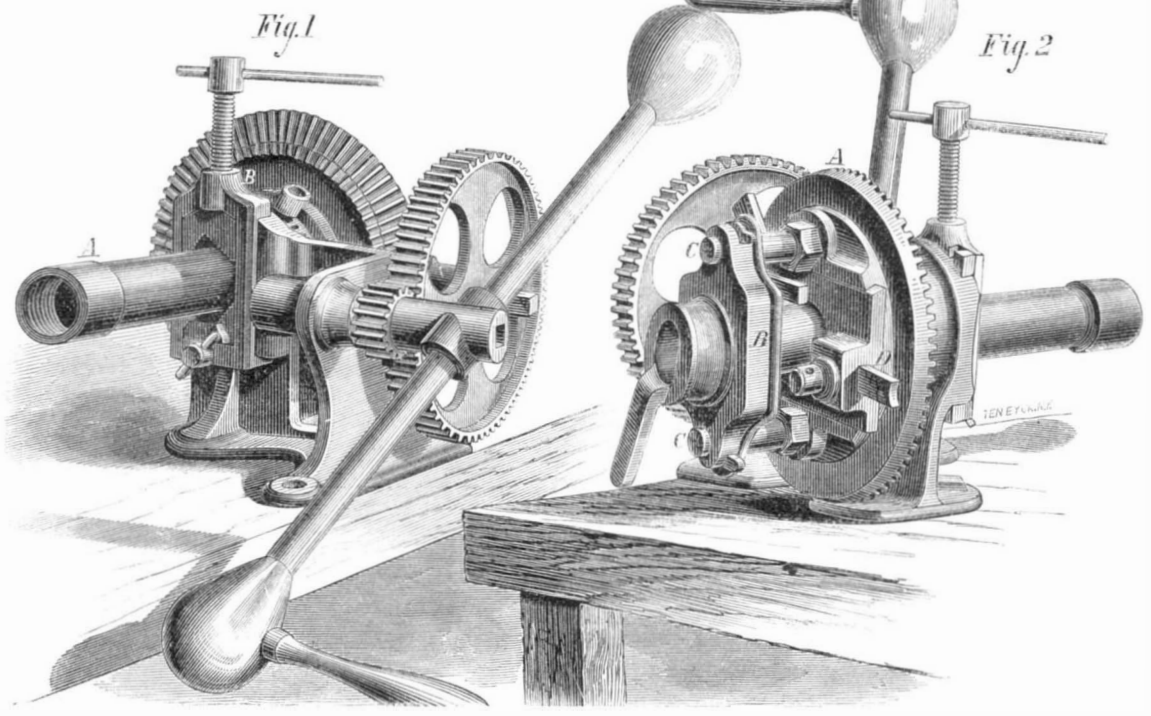
Fig. 2 shows the reverse of the side shown in Fig. 1. The pipe is held stationary in the vise, and passes through the center of gear, A, the rotary motion of which is imparted to the die held in the die box, B, by means of the studs or guides, C C, upon which the die box freely slides forward as the die passes upon the pipe.

When cutting pipe, the tool post, with the cutter, D, has automatic feed, cutting ends of pipe square and smooth.

Wherever steam, gas, or water pipes are used, this machine, it is claimed, will be found of great value, especially upon steamships and in places where economy in space and portability are desirable.

Perhaps we can lay before our readers no better testimonial as to the merits of the device than the opinion expressed regarding it in an official report by Chief Engineer Edward Fithian, U.S.N. That officer says that, in making repairs, etc., on shipboard, the invention would prove a useful and economical tool, as it can readily be set up anywhere, and thus perform a large amount of work which otherwise would have to be taken ashore, to a shop. The report says that it operates with the greatest ease, its capacity is fully equal to that of three men under the old method, and any threading possible with an ordinary die stock is done by it, besides other work. Chief Engineer Fithian recommends the tool "without hesitation."

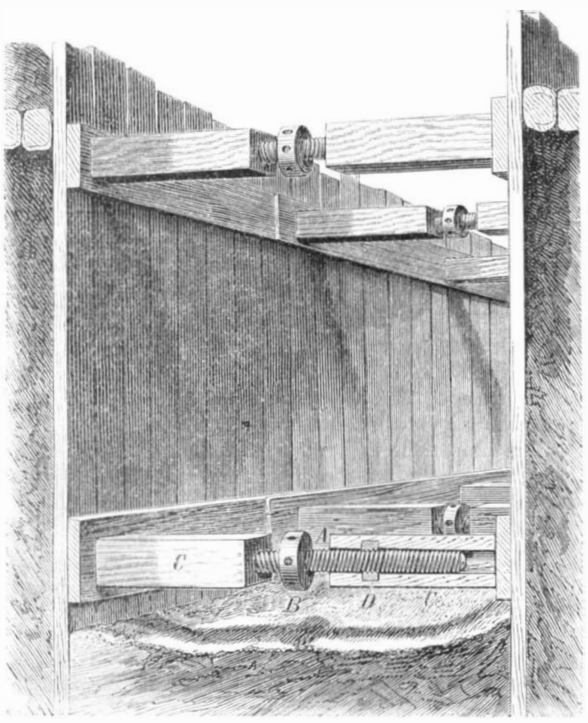
Patented April 27, 1869, and September 30, 1873. For further particulars, address the Chase Manufacturing Company, 120 Front street, New York city.



PIPE CUTTING AND THREADING MACHINE.

IMPROVED TRENCH BRACES.

Mr. Samuel G. McKiernan, of Paterson, N. J., has patented, December 2, 1873, through the Scientific American Pa-



tent Agency, a novel arrangement of adjustable braces for supporting the sheathing of sewer trenches and similar excavations. The construction of the device will be readily understood from the sectional view in the foreground of the accompanying engraving.

There is a rod, A, having a right hand screw thread formed upon one end, and a left hand screw thread upon the other. To the center of this rod is rigidly attached a block, B, in which holes are made to receive a lever by which the device is turned. Two blocks of wood, C, are perforated longitudinally to receive the rod, A; and in these, near their inner ends, are secured metallic nuts, D, into which the threads of rod, A, fit.

In using this invention, when the sheathing planks are placed upright, cross boards are set at suitable distances apart for the blocks, C, to rest against. The inventor adds that his adjustable braces permit of excavations being made by first sinking a hole for the width of one sheathing board. Against each side of the trench a plank is placed horizontally and supported by a suitable number of braces. Then the excavation continues down for the width of another board and the same operation above noted is repeated, and so on until the desired depth is reached. In filling up, the lower board upon each side is first removed, and the earth thrown in, and thus for each plank in turn from the bottom upwards.

Natro-Metallurgy.

The various processes of refining lead, employed at the present day, cause, in cases where the metal is impure, considerable waste, and necessitate the reduction of an enormous quantity of oxide, to which they are besides inadequate for the removal of certain foreign metals. A new plan which has recently been devised by MM. Payen and Roux, of Marseilles, France, allows the complete refining of any argentiferous lead without the formation of oxides of lead, and has, according to the *Chronique de l'Industrie*, the particular advantage of permitting the collection of all foreign metals, of which the value may be worth considering. The process is founded on the property which a bath of caustic hydrated melted alkali possesses in dissolving or at least oxidizing successively all the metals except three, by drawing them into a soluble scoria, in a state of igneous fusion. The three exceptions are lead, silver, and gold. The metals united with the lead are, one after the other, removed by melted soda, the action of the bath being maintained first by a jet of steam, designed to restore constantly the water of the hydrate from which the metals gain oxygen, and urged, according as the metals are in a less degree oxidizable, either by a blast of air, or, finally, by carefully measured additions of nitrate of soda.

The theory of the reaction is as follows: By simple solution in water, soda abandons all the oxides which it holds in solution or suspension, and is evaporated and dried for use in the operation, almost without loss. The metals oxidize in the melted alkaline bath in the order of their affinity for oxygen, an order modified, however: 1, by their particular affinity for soda: 2, by the action of affinity exercised by the largest mass present. Thus tin and the metals of platinum, although much less oxidizable than lead or copper, are attacked very rapidly, and before the latter in the soda bath, by reason of their propensity to act as electro-negative elements. Hence also, in an alloy very rich in lead, the copper oxidizes first.

Another phenomenon of not less importance is that the solutions of the oxides in the soda bath act chemically in presence of the reagents exactly as do the metallic salts dissolved in water. It is thus in this igneous solution: All the metals are precipitated, one after the other, in the inverse order of their solubility; and in the direct order, they preserve each other from oxidation. In this respect, even insoluble reducing agents, such as charcoal, may be employed in the bath.

The principal applications in the process are its adaptation, not only to the refining of lead and the extraction of silver by the zinc process from lead and argentiferous scoria, but the purification of argentiferous copper and old complex alloys; the treatment of ores of platinum, gold, silver, etc., of ores of chromium, etc.

Since March last, the inventors have constructed a plant and have carried on the process at Marseilles; and we learn that the hard leads of Greece (containing 2½ per cent antimony 1 per cent arsenic, ½ per cent copper, and 1 to 2 per cent iron and sulphur), hard Spanish lead, and other forms of the metal containing large quantities of foreign substances, have been successfully treated. A company has been formed for the fusion of ores, separation of metals, and then refining by the processes of natro-metallurgy.

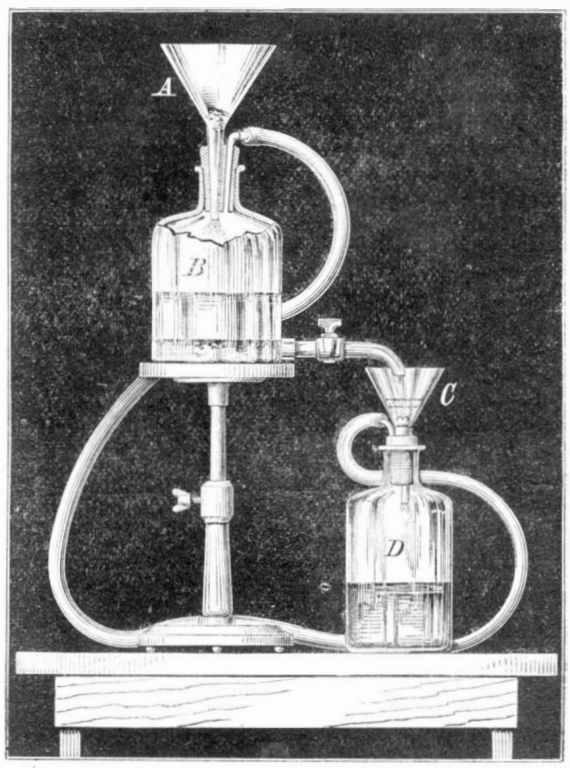
Hot Beds.

Prepare materials at once, consisting of cleanly collected leaves, and rank, but well moistened, stable litter, for the construction of these. In making a hot bed, have a good wide foundation marked by inserting some strong stakes in the corners, for by these stakes the plumb, and hight of the beds, too, can be determined. The foundation should consist of a layer of brush wood, over which asparagus, bean, and pea haulm should be placed, and fermenting material placed over that, being careful to make it firm by beating with the fork in preference to much trampling, and leaving space on either side of the frames for the convenience of linings. One made immediately of equal parts of stable litter and leaves, will be found useful for starting a few early gloxinias, caladiums, achimenes, and roots of *lilium auratum*; also for cuttings of different kinds; and it will afterwards be useful for the raising of various kinds of seeds. Throw into a heap a mixture of two or three parts of leaves and one of litter, and turn it once or twice, applying some manure water if dry; the material may also be used for another bed in February. Besides the hot beds necessary for bringing plants into flower, several are required for vegetable forcing, especially where there are few hot-water-heated structures. In April and the two following months, these beds will be useful for soft-wooded greenhouse plants, such as balsams, cockscombs, some annuals, and various odds and ends. In others, cucumbers, chilies, etc., may be grown; and those not required can be removed and used as manure, or turned for forming a compost for the potting bench. Their size must be in proportion to the amount and continuity of heat they are required to produce. If for starting stove plants on, they may be built as high as 5 feet; but if for growing potatoes, carrots, radishes, and other vegetables, 3 feet will be found sufficient. They sink considerably after being built; and when the heat begins to fail, the best way of recruiting it is by adding fresh linings around the frames.

ON THE PURIFICATION OF MERCURY.

BY PROFESSOR ALBERT R. LEEDS.

In investigations carried on in physical laboratories, and in the volumetric analysis of gases, a large quantity of mercury is employed; and as it is very readily contaminated, a method for its rapid and convenient purification is important.



Such a method must provide for the removal of the three kinds of impurities which are usually present: First, foe reign metals, especially lead, zinc, and tin; secondly, common dirt and dust; and thirdly, water or other liquids.

The most convenient device hitherto employed was a long glass tube, into which the mercury was poured through a paper funnel, the funnel having a pin hole at the bottom, and serving to retain the dirt and dust. The tube was partly filled with dilute nitric acid, and was provided with a stop cock below, or with a bent tube, so that a short column of mercury might balance a long column of acid.

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The device herein recommended consists of a glass funnel, A, capable of holding five or ten pounds of mercury, the tube of which is cut off at a point just below the stopper of the bottle, B. Cotton wool is jammed into the tube until it fills up the neck, and bulges out at the bottom of the funnel. A short glass tube bent at right angles passes likewise through the india rubber stopper of the bottle and is connected with a water air pump. The bottle is two thirds filled with dilute nitric acid (one part of acid and four or five parts of water). The impure mercury poured into the funnel, A, is drawn through the cotton plug in a multitude of streams, and passes as a fine rain through the acid below. The foreign metals, if not in too large quantities, are removed by solution in the acid, and the pure mercury collects below. It is then run off through the stop cock into a second funnel, C; and, after being thoroughly dried by suction through another plug of cotton wool, it is caught and preserved in the bottle, D. A short time suffices for the almost automatic purification of a large quantity of mercury.

Stevens Institute of Technology, February, 1874.

Correspondence.

The Principles of Ventilation.

To the Editor of the Scientific American:

Unless I greatly mistake the intelligence and disposition of the average American, his "scientific" representative will be deluged with articles protesting against the crude notions contained in the article coming from "the land o' cakes," entitled "The Ventilation of the United States Senate Chamber." I purposely ignore the special subject of his article, the senate chamber, and beg leave to refer very briefly to some of the most untenable of his general assertions.

He boldly asserts that "the whole secret of ventilation consists" in providing "an entrance for fresh air below and an exit for foul air above," and bases this erroneous idea upon the false assumption that "foul air," making no distinctions, "ascends and accumulates at the ceiling" only. He also says: "If our halls, like the ancient Greek houses, were without roofs, ventilation would cause no thought," for "the foul air from our lungs and bodies would ascend right into the air, and a fresh supply would come down to us through the same opening."

As a simple and plain refutation of his statement regarding the tendency of foul air to "accumulate at the ceiling," I would refer him to the familiar experiment of placing a bit of lighted candle at the bottom of a tall glass jar with open top. He will find, upon exhausting the lungs into the bottom of the jar, by means of a tube, that the light will be extinguished almost immediately; and if he breathe downward into the jar—not directly over the flame, but near the side of the vessel—the light will just as certainly be put out as in the previous experiment, only the inevitable and fatal result will be retarded. If, instead of the lighted candle in the tall jar, he places "the ancient Greeks" or a few live Scotsmen in a "high" room, closed at the bottom and open to the free air of heaven at the top, he will find results quite parallel to those in his previous experiments. Any causes favoring the sudden generation of an excessive amount of carbonic acid gas would result in speedy death to them all, or in asphyxia, as in the first experiment. Confinement in the same place, under more favorable circumstances, would somewhat retard the fatal result; but ultimately, as the air became contaminated by poisonous exhalations, languor, decay, and death by some "chronic" malady, would occur as surely as the light was slowly extinguished in the second experiment.

In both these instances, "the destroying angel" is carbonic acid; it is the principal deleterious element which contaminates the air we breathe, and to which we are most universally exposed; it is generated by decomposition, by combustion, and by respiration. At any ordinary comfortable living temperature, the specific gravity of this poisonous gas, even when exhaled from the lungs, is greater than that of the surrounding air; therefore it of necessity gravitates to the bottom of the jar or to the bottom of a room, instead of rising to the ceiling. No matter what may be its source, if in excess it is "the destroying angel," always injurious, often fatal. We find, in what is called pure air, about 4 5 parts of carbonic acid to 10,000 of air; the open air of cities is often contaminated by from 6 to 15 parts to 10,000, while the confined air of some public halls and school rooms has been found to contain as many as 75 parts to 10,000, in such cases rendering the air absolutely poisonous.

If warming were not inseparably connected with proper ventilation, as, unfortunately for the position of your correspondent, it is in our climate, it might do to provide only for the escape of foul air above and the introduction of fresh air below; but, as he admits, "one undeviating law of air currents is that they always take the shortest cut, and depend upon it" the necessary and inevitable effect of providing an opening for inlet below and an opening for outlet above would be to "freeze out" the inmates of a room, whether the incoming fresh air is warm or cold. If cold, the incoming fresh air would spread itself out and fill the lower part of the room first; if warm, it would immediately take "the shortest cut" and escape at the top, without materially affecting the temperature or the quality of the air throughout the room, except in the direct course of the moving current, which would be from inlet to outlet.

For these plain reasons, the crude method advocated by your correspondent is not commendable even in a warm climate or in the summer weather, for then, if the doors and windows be left open, the air will freely circulate in any natural direction. In short, his positions are contrary to the advanced experience and philosophy of such able specialists as Box (see his work on heat) Reid, Ruttar, Leeds and others on ventilation. His ideas are diametrically opposed to modern practice and experience, especially in the West, where the downward exhaust principle has been introduced very generally in nearly all new public and private buildings.

A. R. MORGAN.

To the Editor of the Scientific American:

Your correspondent, Mr. Wm. Mackean, in his article on ventilating the senate chamber, must either allude to summer ventilation or be without practical experience of the subject; for ventilation in cold weather, when we require warmth and comfort as well as air, necessitates an entirely different arrangement.

First, if he use an opening of two square feet in the roof for ventilation, and numerous smaller ones (their combined areas being equal to or less than the roof aperture) in the floor or wainscoating, the heated air would go direct to the opening in the roof, warming the surrounding air but little, and leaving the large body of air in the room very cold. I have seen the temperature of a room fall 3° in 5 minutes on opening the hot air register in the floor and the ventilator in the ceiling; and although the fire was kept up about four hours, the temperature did not rise half a degree.

Secondly, he says that the air, on being discharged from the lungs, is warmer than the surrounding air, and therefore rises; which is true, but it only rises a short distance, when it becomes of the same temperature as the air through which it passes; and being loaded with matter thrown off from the lungs, it becomes heavier and falls to the floor to be again inhaled.

There is a vast difference between ventilation in the summer and ventilation in the winter, also between a building heated by hot air and one heated by direct radiation from a heated surface.

CHARLES A. WEST.

Richmond, Va.

The Centralization of Matter.

To the Editor of the Scientific American:

A few modern scientists have recently proclaimed the theory that the resistance of space to the planets, in their revolutions around the sun, will ultimately cause them to approach to and become part of the sun. Another writer says that the centralization of matter is one of the great laws of Nature, which will eventually produce the same result: that each satellite, as it loses its internal heat, will be absorbed by its planet, and the planets by the sun. I do not know whether this is orthodox science, or whether it is a "new departure;" but if this process of Nature is in existence, it certainly has been going on for all time, and our own planet should exhibit some of the results or footprints of this great law. Therefore I ask: Has the earth, since it has taken its place as a planet, received any accession of considerable bodies of matter, going to make up the great mass it now presents? Most assuredly it has; several of the continents still bear unmistakable evidence of being a deposit of this character, having probably been former satellites of the earth, and to have been precipitated upon it without great violence, but sufficient to crumble and scatter their contents in the direction of their motion. South America bears the most striking illustration of a phenomenon of this character. When the satellite had gradually wound its diminishing orbit, until it came within the confines of the earth's atmosphere, by a storm or commotion below it is suddenly enveloped in our heated atmosphere; and losing its hold upon the cold medium of space, with a plunge it is precipitated to the earth. The first contact is at Cape Horn; then with a rolling, settling, and crumbling motion, it spreads out nearly to its present limits, and, while yet in motion, commences the grandest feature of all. Before this great mass of *débris* can acquire the motion of the earth in rotation, the great waters and sediment of the Pacific are surged up to the very clouds, rolling up the western border like a scroll, of which the Andes bear witness, and of which your correspondent, Professor Orton, (page 40 of your current volume) says: "Here the landscape was purgatorial, presenting the confusion of the grab box of a geologist."

The fact that guano is now admitted to have been a sediment of the ocean, and is fouad on the mountain sides, as well as on the islands, and that the beds of the ocean (especially the Atlantic) are crushed down near the borders of the continents, all tend to confirm this theory. The crowding up of the Andes proves that the earth was rotating in about the same position as now, although what is now Cape Horn may have been near the equator before this occurrence. As the surface of the satellite would be a frozen mass, her glacial period would soon have an end; and the sudden acquisition of so large a body of matter on one side of the earth (within what is now the southern hemisphere) would necessitate the withdrawal of a large body of water from the northern hemisphere to establish an equilibrium, and complete the spheroid. Hence the greater exposure of land surface now in the northern hemisphere, much of which is known to have been submerged.

Where then is the base line of geology, when we find that our igneous rocks were produced in other worlds, before being deposited with us?

A. D.

A Substitute for Mica in Stoves.

To the Editor of the Scientific American:

The want of durability in mica and the difficulty in bending it renders the application of another material desirable. My observations have convinced me that we have the most desirable qualities in thin glass tubes, so arranged as to present an even and a nearly airtight surface. As glass tubes are drawn at the glass houses, they are slightly though perceptibly conical, a matter of no moment, as, by alternating the larger and smaller openings, when they are laid parallel, close joints result.

Three kinds of glass are met with in the market: Brown bottle, greenish lime, and cullet and flint glass, more or less perfect. Either of these kinds may be used, as radiant heat from the fire will anneal them; flint glass, being the most pliant, is best adapted to the nicer purposes. Tubes drawn quite thin, from one eighth to one third of an inch bore, may be used, always with reference to the thickness of the envelope of which they form a part. They may be arranged side by side, either vertically or horizontally, to fill any size or space, resting loosely in a recessed space or in a clip of malleable metal to support them and exclude dust. Combinations of shorter and longer tubes may be used for paneling or otherwise varying the surface. But ornamentation will doubtless be best gained through colored and particolored tubes, so arranged as to produce the most pleasing variety. It is well known that silvering within the colorless or colored tubes can be easily so adjusted that much light will be transmitted, while on another part the luster of burnished metal may be obtained, while little light is lost.

Sliding, folding, and curved screens of any size, flexible or fixed, can be formed with these tubes, so that stoves with open or closed fronts may be made. There is not the slightest risk of fracture of the tubes, excepting from a blow or similar accident; and any partial destruction can be repaired by substitution in a few minutes' time; indeed, the pliancy of the structural forms of large size is a safeguard. Washing or other cleansing of the surfaces can be done without danger when the glass is cool.

The increased consumption of glass in this way will diminish its cost in the form of small tubes, and lead to the introduction of ornamental and beautiful designs in all appliances for warming apartments by visible fires.

A. A. HAYES.

Electroplating Pewter Surfaces.

To the Editor of the Scientific American:

I noticed in a recent number of the SCIENTIFIC AMERICAN that a correspondent experienced great difficulty in plating pewter surfaces. To him, and all others who have met with similar difficulties, I will give the following recipe, which will be found simple and very effective:

Take 1 ounce nitric acid and drop pieces of copper in it until effervescence ceases; then add ½ ounce water, and the solution is ready for use. Place a few drops of the solution on the desired surface, and touch it with a piece of steel, and there will be a beautiful film of copper deposited. The application may be repeated if necessary, though once is generally sufficient. The article must now be washed and immediately be placed in the plating bath, when deposition will take place with perfect ease. This is an excellent recipe, and should be known to all electroplaters.

Friendsville, Ill. JAMES POOL.

About Ourselves.

To the Editor of the Scientific American:

We have come to the conclusion that a thing of real practical value has but to be advertised in the SCIENTIFIC AMERICAN to insure its success. From one week's advertisement of our small Welch Water Engine, in your columns, we have answered as many as eighty letters in a single day. That single advertisement will pay us largely as an investment, unless the overwhelming amount of correspondence therefrom really ruins us.

THE NEW ENGLAND MOTOR AND MOWER COMPANY.

Danbury, Conn.

The Aerophore.

This is an apparatus for enabling persons to breathe and work, with a light, in unbreathable and explosive gases in mines, wells, sewers, and caverns. It is the invention of Messrs. Denayrouze, of Paris. The aërophore consists of a number of large or small cylinders as desired, which are lowered into the mine with the workman. Connected with the cylinders is a long flexible tube about an inch in diameter, of such strength that it cannot be damaged even by being trod upon. The person who is to use the aërophore first puts on a strongly made jacket of webbing, to the back of which is attached a couple of moderating valves which serve to supply the compressed air to the mouth at ordinary atmospheic pressure—not higher—the pipe being attached to these valves. Another pipe passes over the shoulders and to a mouth piece. The nostrils are closed by a nipper. The mouth piece is constructed so as to be available either for a light or heavy breathing man. Exhalation is accomplished by means of a small aperture in the tube about two feet from the mouth. This aperture is fitted with a proper valve, which stops the ingress of all air or gases. By another valve and tube, air is supplied to the lamp which the miner carries in his hand, and enables it to burn brightly, and a pair of "goggles" are provided in case the eyes are likely to be affected. These can readily be fastened on by means of an elastic strap.

D. D. S. writes to suggest that lightning rods be made in the form of an elongated oval, about 6 feet wide, so that the conductor would present the appearance of two rods, side by side, joined at the top; and they would also be joined under ground. He thinks that this arrangement will give better protection to a building, from the better ground communication it would afford.

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Richard Trevethick's Thousand Feet Tower.

Mr. F. S. Hoffman, of Philadelphia, Pa., writes to remind us that the eminent engineer Trevethick proposed to erect an iron tower 1,000 feet high, in commemoration of the passage of the Reform Bill in England in the year 1832. In that year he sent a note to the London *Morning Herald*, which contains the following:

"Design and specification for erecting a gilded conical cast iron monument (scale 40 feet to the inch), of 1,000 feet in hight, 100 feet in diameter at the base, and 12 feet diameter at the top; 2 inches thick, in 1,500 pieces of 10 feet square, with an opening in the center of each piece 6 feet diameter, also in each corner of 18 inches diameter, for the purpose of lessening the resistance of the wind, and lightening the structure; with flanges on every edge on their inside, to screw them together; seated on a circular stone foundation of 6 feet wide, with an ornamental base column of 60 feet high; and a capital with 50 feet diameter platform, and a figure on the top 40 feet high; with a cylinder of 10 feet diameter in the center of the cone, the whole hight, for the accommodation of persons ascending to the top. Each cast iron square would weigh about three tuns, to be all screwed together, with sheet lead between every joint. The whole weight would be about 6,000 tuns. The proportions of this cone to its bight would be about the same as the general shape of spires in England. A steam engine of 20 horse power is sufficient for lifting one square of iron to the top in ten minutes; and as any number of men might work at the same time, screwing them together, one square could easily be fixed every hour; 1,500 squares requiring less than six months for the completion of the same. A proposal has been made by iron founders to deliver these castings on the spot at £7 ($35) per tun; at this rate, the whole expense of completing this national monument would not exceed £80,000 ($400,000). By a cylinder of 10 feet diameter, through which the public would ascend to the top, bored and screwed together, in which a hollow floating sheet iron piston, with a seat round it, accommodating 25 persons; a steam engine forces air into the cylinder column from a blast cylinder of the same diameter; and working three feet a second, would raise the floating piston to the top at the same speed, or five or six minutes ascending the whole hight; the descent would require the same time. A door at the bottom of the ascending cylinder opens inwards, which, when shut, could not be opened again, having a pressure of 1,500 lbs. of air tending to keep it shut until the piston, descends to the bottom. By closing the valve in the piston, it would ascend to the top with the passengers floating in the air, the same as a regulating blast piston, or the upper plank of a smith's bellows. The air apparatus from the engine should be of a proper size to admit the floating piston, with the passengers, to rise and fall gradually, by the partial opening or shutting of the valves in the top of the piston. Supposing the springs or soft substance, for the piston to strike on at the bottom of the column cylinder, descending three feet a second, would give no greater shock than falling from 9 inches high, that being the rate of falling bodies, or the same as a person being suddenly stopped when walking at the rate of two miles an hour. The pressure of the air under the piston would be about half a pound on the square inch; the aperture cannot let the piston move above 3 feet a second, but this speed may be reduced to any rate required by opening or shutting the valves on the floating piston."

"Within two months," says Trevethick's biographer, "from the date of the design for a gilded column, Trevethick had passed away. His family in Cornwall received a note, dated April 22, 1833, from Mr. Rowley Potter, of Dartford, stating that Trevethick had died on the morning of that day, after a week's confinement to his bed. He was penniless and without a relative by him in his last illness, and for the last offices of kindness was indebted to some who were losers by his schemes.

Trevethick's grave was among those of the poor buried by the charitable; no stone or mark distinguished it from its neighbors. He is known by his works. His high pressure steam engine was the pioneer of locomotion and its wide-spreading civilization. England's mineral and mechanical wealth on land and sea are indebted to its expansive power, its applicability, and durable economy."

The Semi-Centennial Anniversary of the Franklin Institute.

The Franklin Institute recently celebrated the semi-centennial anniversary of its foundation, at the Musical Fund Hall, in Philadelphia. Mr. Coleman Sellers, the President, presided, and delivered an address, in which he sketched the past work of the Institute, and its influence upon the mechanical and scientific progress of the country. An earnest plea was made in behalf of technical education, and the value of proper instruction for working men warmly advocated.

Mr. Frederick Fraley, one of the founders of the Institute, gave some interesting recollections of its establishment, and said the first meeting was held in the County Court House, in Philadelphia, on February 5, 1824. Professor R. E. Rogers spoke upon the immense progress of knowledge which has occurred during the past half century, and, in quite a lengthy address, reviewed the history of inventions, beginning with Fulton's steamboat and ending with the most recent developments in astronomy, physics, and other mechanical and scientific professions.

President Morton, of the Stevens Institute, pointed out that, in the view of Science, the universe of matter is as truly the universe of motion, and hence the branch of study to which we should most devote our attention is that which treats of matter in its relation to motion, in other words, to "mechanics." It is to the development of this knowledge that the Franklin Institute has contributed during the last fifty years. The speaker compared the advancement of the world to the gradual growth of a child; and in conclusion, he said that the necessities of the age are new means of applying great truths already discovered.

Electroplating.

At a session of the Physical Association held in Frankfort on August 30 last, Dr. Otto Volger delivered an address on the history and progress of the art of depositing metals by galvanic action, of which the following is an abstract:

At an early date it was known that a current of galvanic electricity was able to decompose liquids, and that metals deposited from solutions of their salts by this means assumed fantastic shapes, which appeared so similar, at the first glance, to vegetable growth that they were called galvanic trees, or metallic vegetation, although really consisting of crystals, and formed according to the laws of crystalization. Professor Böttger took especial delight in producing this sort of vegetation with different metals.

The use of such metallic deposits for electroplating was discovered accidentally. In 1830, Mr. J. P. Wagner, of Frankfort, and Professor Jacobi, of St. Petersburg, were endeavoring to employ electromagnetism as a motive power, instead of steam. Jacobi employed a Daniell's battery, which is distinguished for its constant and regular action. It consists of an outer cup of copper, and an inner cell of unglazed porcelain which contains the zinc rod. The intermediate space is filled with a saturated solution of sulphate of copper. When the battery is working, this solution of blue vitriol is slowly decomposed, depositing metallic copper, which finally becomes injurious, and must be removed. Once when Jacobi was busied with removing such a deposit from his copper cup, he noticed that there were several layers of copper, each having the form of the sides of the copper vessel, and hence, concluding that the sheet copper of which the vessel was made had split up into layers, he accused the man who made it of employing a poor quality of sheet copper. A closer investigation, however, showed him that these layers, or leaves, did not belong to the walls of the vessel, but to a new deposit of metal, which imitated, in a remarkably perfect manner, the shape of the surface of the walls. It occurred to Jacobi that this troublesome disadvantage could be turned to profit by using it for reproducing objects. In 1838, he communicated to the St. Petersburg Academy a description of his discovery of the use of galvanic electricity for reproducing objects in the arts.

Czar Nicholas requested a German chemist named Klein, who was then employed in the imperial printing office, to test the practicability of the discovery and to ascertain to what extent it was capable of development. The answer being a favorable one, he gave the discoverer the means of making his new art the common property of the whole world.

Electrotyping or plating with copper consists in merely making the object to be copied the negative element of a simple Daniell's battery. If the object is a conductor, metal for instance, and is to be only partially covered, the parts that are to remain uncovered are rendered non-conductors by coating with some non-conductor, as wax, stearin, or varnish. If it is a non-conductor, its surface is rendered conducting by brushing it over with a thin film of the finest graphite or silver powder. Murray discovered that graphite works the best. The reaction consists in the separation of the sulphate of copper into sulphuric acid and oxide of copper, while the water is simultaneously separated into oxygen and hydrogen. The sulphuric acid liberated at the anode or positive pole unites with the oxide of zinc, formed there by the oxygen given off from the decomposed water, to form sulphate of zinc, which goes into solution.

The hydrogen evolved at the opposite pole abstracts the oxygen from the oxide of copper, and forms water, while the copper is left in a metallic state. Hence it is really the hydrogen which causes the reduction of the oxide of copper to metallic copper, at the negative pole or cathode.

Up to the year 1840, this new art was only employed for making small copies, like coins and medals, and these often came out of the mold imperfect, or were broken in detaching the mold. At that time, however, Professor Böttger prepared handsome relief plates of copper, and also employed galvanism for depositing a metallic coating on other metals, as for instance gilding silver, copper, and brass. In the same year, a copper plate engraver, named Kress, came to St. Petersburg, learned from Klein the galvanoplastic art, as Jacobi had named it, and became acquainted with the latter. Jacobi called his attention to the fact that he could in this way make perfect copies of his etched or engraved plates, thus multiplying the original plate so as to obtain a great number of the most excellent impressions; for it is well known that a plate soon loses its sharpness, and every impression is poorer than the preceding one. At this suggestion Kress took up the art, and by 1844 had brought it to great perfection in his business. In 1841 Professor Böttger had made a copy from one of Professor Felsing's copper plates, in Darmstadt (the *Ecce Homo*, after Guido Reni, 12½ inches by 9½ inches), which was so perfect that Felsing declared that proofs printed with it were identical with those from the original plate, and of equal value. These plates are still in existence, the one in Berlin Museum, the other at Frankfort on the Maine.

The galvanoplastic art has extended itself in three directions: 1. For covering other metals, as in electroplating with gold, silver, copper, steel, and nickel. 2. In producing objects formerly cast in metal. This has been brought to great perfection in several German cities, especially Mayence, where the smallest natural objects are copied and the largest works of art produced. Among the latter are three colossal figures on a monument in Frankfort. 3. The reproduction of engraved and stereotyped plates, and the like. In the latter, farther progress is still possible.

Early in 1840, Péligot reduced protochloride of iron by passing hydrogen gas over it, and in this way obtained metallic iron in octohedral crystals and in malleable plates. In 1846, Professor Böttger made the first attempt to decompose the chloride of iron by the electric current, and with success, but soon found that a mixture of the double sulphate of iron and ammonium and the double chloride of iron and ammonium was better for electroplating. This he prepared by dissolving simultaneously 2 parts by weight of protosulphate of iron and 1 part sal ammoniac in water. As anodes he employed a piece of sheet iron; the cathode at once acquired a polished appearance from the metallic iron deposited on it. In this way he copied a florin in iron (several such specimens were exhibited by the lecturer.) The iron is very hard, like steel, but unfortunately very brittle, so that it frequently breaks in taking it from the mold. No technical use could at first be found for it. In 1859 Jacquin found an application of it in covering copper plates with steel. This consisted in precipitating on the copper an extremely thin film of iron, which did not destroy the sharpness of the impression, but by its hardness offered such a protection to the copper that the latter was almost as durable as a steel plate. In this process, also, Professor Böttger's recipe proved the best and was generally followed.

Recently, a chemist in St. Petersburg, also named Klein, has brought electroplating with iron to a remarkable degree of perfection. In 1868 he exhibited, before the St. Petersburg Academy, excellent results which he had obtained by using a solution of bisulphate of the protoxide of iron, and a Meidinger battery, with a piece of sheet iron as anode. Klein deposited the iron in large plates both thick and thin, as copies from engraved copper plates, and thus combined a soft, easily wrought plate for the engraver, and an iron plate as hard as steel for the printer. The iron thus deposited was, to be sure, very brittle, which Klein found to be due to the hydrogen occluded in it, its specific gravity being 7·675, or a little higher than rolled iron. By heating the iron, he succeeded in expelling the hydrogen, when it became more dense, and had a specific gravity of 7·811, which is higher than wrought iron. It was perfectly malleable, highly elastic, and could be welded like sheet steel, in short, was an excellent malleable iron. Klein has prepared plates of this iron weighing 16 lbs.

Electroplating in iron will find an important and extensive use in manufacture of stereotype plates, especially for printing government paper and postage stamps, where colored inks are employed, for the iron would not be attacked by the colors containing mercury, which acts on copper and other metals.

In conclusion, the lecturer referred to the occurrence of native metals in the earth, and the theory, advanced almost 30 years ago, comparing the earth to a voltaic battery. Hardinger believed that he could prove that the surface of the earth was the anode and the interior of the earth the cathode of a galvanic battery. According to this, native metals should only be sought deep down in the earth, which is not always the case. It is much more probable that native metals have been reduced by the decomposition of organic matter. This applies especially to copper, and also to the very rare telluric iron. The graphite found in the latter, is to be considered as the residuum of decomposed organic compounds. In the Rotanger sea in Sweden, native iron is found replacing particles of wood, as if petrified, and the microscope is able to detect the cells and determine that it was a species of pine wood. The interior of the cells is also filled with a deposit of iron. This is not to be attributed to the action of a galvanic current, but to the reducing power of the hydrogen liberated from the decomposition of organic matter.

Borax for Colds.

A writer in *The Medical Record* cites a number of cases in which borax has proved a most effective remedy in certain forms of colds. He states that in sudden hoarseness or loss of voice in public speakers or singers, from colds, relief for an hour or so, as by magic, may be often obtained by slowly dissolving, and partially swallowing, a lump of borax, the size of a garden pea, or about three or four grains, held in the mouth for ten minutes before speaking or singing. This produces a profuse secretion of saliva, or "watering" of the mouth and throat, probably restoring the voice or tone to the dried vocal cords, just as wetting brings back the missing notes to a flute when it is too dry.

A correspondent, Mr. A. O. Kruger, reports the discovery of a copper mine at Isle Royal, Minn., which yields ore of a quality similar to those of the Calumet and Hecla mines on the south shore of Lake Superior. It is in a conglomerate rock, the belt of ore being 26 feet between foot and hanging wall, and has been found at points 14 miles apart. Our correspondent states that preparations for mining on an extensive scale are in contemplation, and that the discoverers believe that it will be the largest copper mine in the world.

"A Railroader" writes to suggest placing a partition in the sand box of a locomotive, so that screenings of sand or gravel may be used if required. A second rod would be required to let the gravel on to the rail; but the coarser stuff would be very useful when the metals are covered with ice or snow.

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[*Continued from first page.*]

tion of this cock may be altered to suit conditions of accessibility, etc. It doubtless has been surmised that the escape of a strong current by the valve, would, when the gas is first admitted, produce a vibratory motion or chattering of the valve. To avoid this, the inventor supplies a push pin, I, which is pressed down by the flange and held by the weight, J, above it, until its lower extremity strikes the valve stem, thus steadying the latter until the gas has entered the distributing mains, and the proper conditions of pressure above and below the valve result. The pin is then released, when it returns to its normal position.

Another application of the device, essentially the same, though differing somewhat in construction, is shown in Fig. 3. The apparatus is here placed in the main leading from the gasometer. The latter is weighted or otherwise arranged to give the fullest pressure ever necessary, and the regulator governs the quantity of that force required for existing needs. The mains, A A, enter a box which is divided into two compartments, as shown. In the diaphragm the valve, B, is seated, and the area of its face is made sufficiently large to compensate for the low pressure coming from the holder; or about equal to, or perhaps a little greater in diameter than, that of the main. C C are the weights, and D the push pin, acting exactly as above described. E is the cock for drawing off deposits, etc. Of course the advantages of this adaptation are about the same as already described, only more extended. For instance, if we lived next door to a theater or hall in which a thousand burners were nightly lit, this wholesale illumination, the inventor tells us, would be without effect on the dozen or so lights in our dwelling. It has also been suggested that the regulator might be advantageously located in various quarters of a city, so as to regulate the supply of gas—or water, just as well—in accordance with the extent of the demand.

In Fig. 4, we show an application of the device toward the regulating of the descent of water in pipes down mountain sides. Commencing at the summit, it is proposed to place a regulator, A, at a point in the pipe where the water attains a pressure say, of 120 pounds, so as to reduce the latter to 20 pounds. Then further down, after the water again assumes the first mentioned pressure, a second regulator, B,

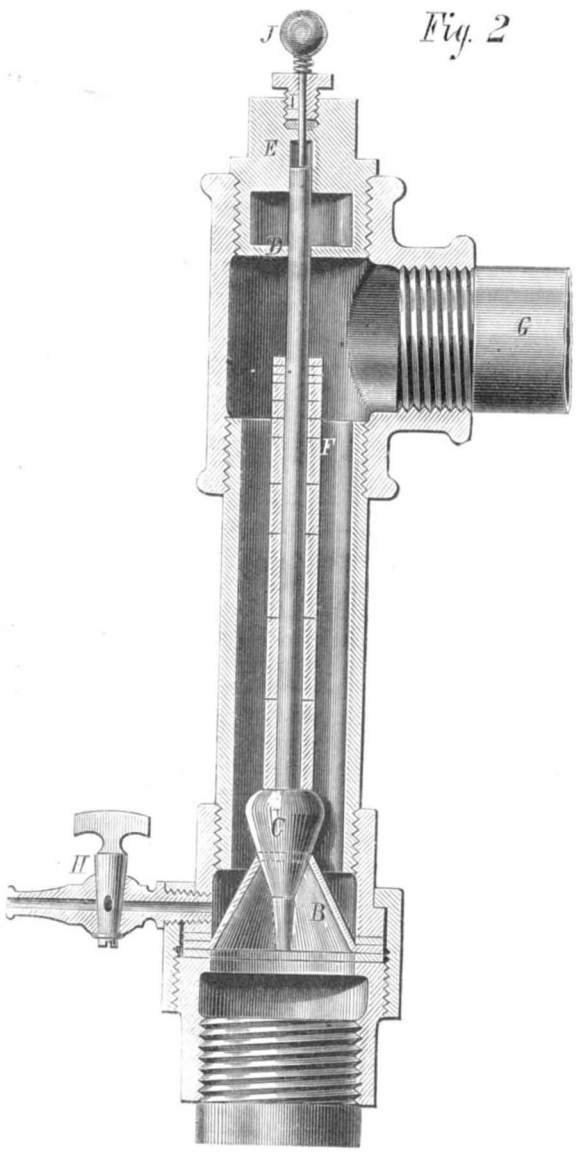

Fig. 2

is located, and the force is a second time reduced. This is continued until the descent is complete. By this means the water can be safely carried down any declivity, however long and steep, without undue strain or injury to the pipes.

Our large front page illustration is intended to show how the invention may be applied to regulating the water supply of an entire city, so as to change the pressure, in the mains, to the high force useful in throwing streams for extinguishing fires, from the working pressure ordinarily employed This may be adapted to the Holly system of water works, in which the water is pumped directly from the river by powerful engines usually constructed in substantial buildings on the banks, and of the type represented in our engraving, and subsequently driven through the distributing mains. The idea in this case is to divide the main into two branches which are afterwards reunited. In each branch a regulator is placed, and through each the water may be directed by opening or closing the valves shown. The regulator in the fire pressure branch is adjusted to pass a powerful stream, while that in the other admits of the escape of a current of a force just necessary to insure the complete distribution of the water to all parts of the town.

Another advantage which the inventor claims is that the pressure is equalized throughout the entire system of pipes, so that the latter may be of a uniform strength over their extent, and not subjected to undue strains at any point beyond the valves.

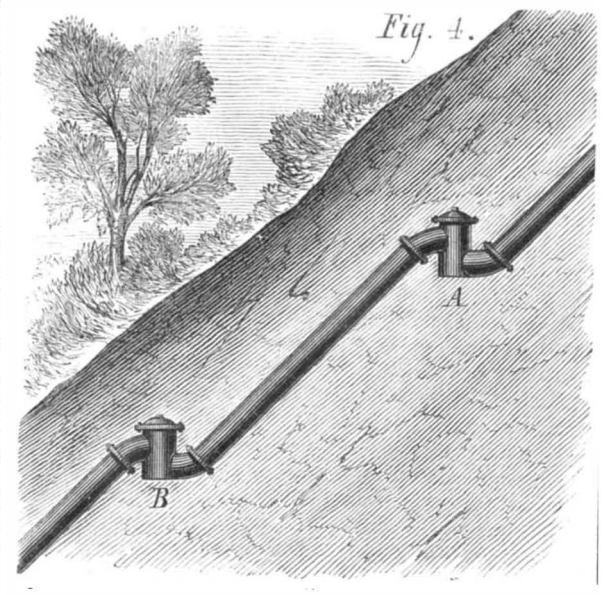

Fig. 4.

We have now cited sufficient modes of application of the invention to give our readers a fair idea of its value and uses. The inventor informs us that he has made it the subject of practical tests with invariably successful results, and that it has been in operation in his own dwelling, as we before stated, regulating the flow of his gas well for some time past. He is enabled to gage just the pressure he requires, either for fires or lights, by suitable arrangements of pipes and differently adjusted regulators. The device is susceptible of ready adaptation to the purposes of a safety valve for steam boilers, for regulating the water pressure in cooking ranges, water backs, etc., or the pressure of compressed air or vapors.

Patented, through the Scientific American Patent Agency, in the United States, Canada, England, Australia, and most of the countries of Continental Europe. The inventor is Mr. Daniel T. Casement, of Painesville, Lake county, Ohio. Letters for further information should be addressed for the next three months to the patentee, at the Fifth Avenue Hotel, New York city.

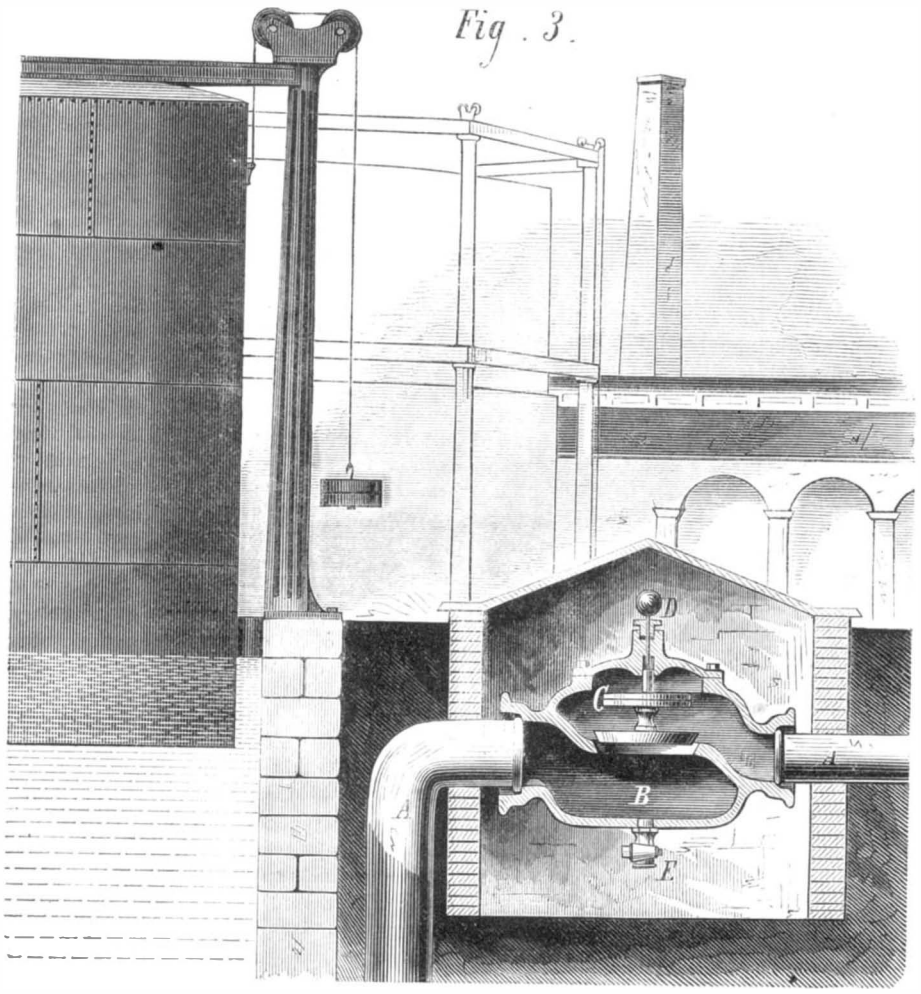

Fig. 3.

CASEMENT'S PRESSURE REGULATOR FOR FLUIDS.

The Page Patent Litigation.

There seems to be a probability that the validity of the Page patent will be thoroughly and legally tested. We have before mentioned in *The Telegrapher* the fact that suits had been commenced in the United States Courts against the Manhattan Quotation Company and Mr. Charles T. Chester, of this city, for infringement of this patent, and they are to be contested to the end, and its validity, as affecting telegraph instruments and apparatus, either established or denied judicially.

Our readers are fully aware of our opinion in this matter, and we have shown, as we think, conclusively, that Professor Page was not the original inventor of the devices for which a patent has been granted to him, and that, in fact, the patent is an outrage on the public, who have paid largely for these same devices to other patentees, whose patents have expired and become public property. So well convinced was the Western Union Company of the invalidity of the patent that, when first offered to them for purchase, after an investigation by experts and eminent patent lawyers, it was rejected. It was subsequently purchased by that company for good and sufficient reasons, no doubt, not connected with its validity, and has, for the last three years, been held *in terrorem* over the telegraph interests of the country not connected with the Western Union—no serious attempt having heretofore been made to enforce it.

It should, by all means, be disposed of at as early a day as possible. If properly contested, that it can ever be maintained legally we regard as an impossibility.

The resources of the Western Union Company will enable them to press the matter, and the contest will be protracted and expensive. All who are interested in defeating it should at once join hands with the defendants and make common cause with them, sharing the expenses as they will the benefit of success. The railroad companies are especially and vitally interested in this matter; for if the Page patent be once established, they are at the mercy of the Western Union Telegraph Company, so far as their telegraph facilities are concerned, and will be made to pay roundly for the exemption from such control during the last few years, since the Morse patents expired. They should be wise in time, and cooperate with those who are engaged in supporting the independence of the telegraphs of the country.—*The Telegrapher.*

Beach Mining in California.

On the coast line of Klamath county, Cal., there is a remarkable deposit of auriferous gravel. For nine miles along the beach an unbroken line of cliffs, towering from one to five hundred feet, serves as a sea escarpment to the mountains behind, and these are immense masses of gravel of varying size and of distinctly marked layers or stratifications. In these "gold bluffs," as they are termed, the precious metal is found in considerable quantities, principally in the tenth strata, which is "black sand" or gravel with iron cement.

Mr. A. W. Chase, in a paper read before the California Academy of Sciences, gives a graphic description of how the mines are worked; and as the labor is carried on without shafts, tunnels, timbers, pumping or hoisting machinery, it may be inferred that the expense of exploration is not excessively large.

After the sand is reached, it is shoveled into little piles and thence into canvas bags, containing about 125 pounds each. These are loaded on mules, each animal carrying two, and thus transported to the "sand corral" in the works. The washing is done in "Long Toms" with copper plates, the latter being first coated with silver, before the quicksilver is applied. Mr. Chase states that, during the week he visited the mines, $1,600 was retorted from the washings of two machines. He points out that, as the experience of the successive proprietors of this extraordinary gold mine goes to prove that, immediately after a heavy cave or slide of the banks, the beaches are richer and the gold coarser, it seems strange that, up to the present time, no artificial means have been resorted to in the way of blasting down the cliffs or undermining them by hydraulic process to increase the yield of gold. The sea, working ceaselessly night and day, is the great natural separator, and man has but to gather the results of its tireless work. Many ideas have been advanced as to the possibility of gold in quantities and coarser in character being found beyond the line of surf, predicated on the fact that it, in conjunction with black sand, has been said to have been brought up from the bottom by the leads of sailing vessels. Several expeditions have been fitted out at San Francisco to procure this sand by means of diving apparatus, etc., but none of them were successful.

THE UTILIZATION OF IRON PYRITES.—In connection with this subject, Messrs. Dobschütz and Abend state that large quantities of coal, unfit for smelting purposes on account of the pyrites it contains, are mined in Illinois. The coal does well for steam raising; but being useless in metallurgy, it is sold for about 2½ cents per bushel, and is even burnt to prevent its cumbering the ground near the mines.

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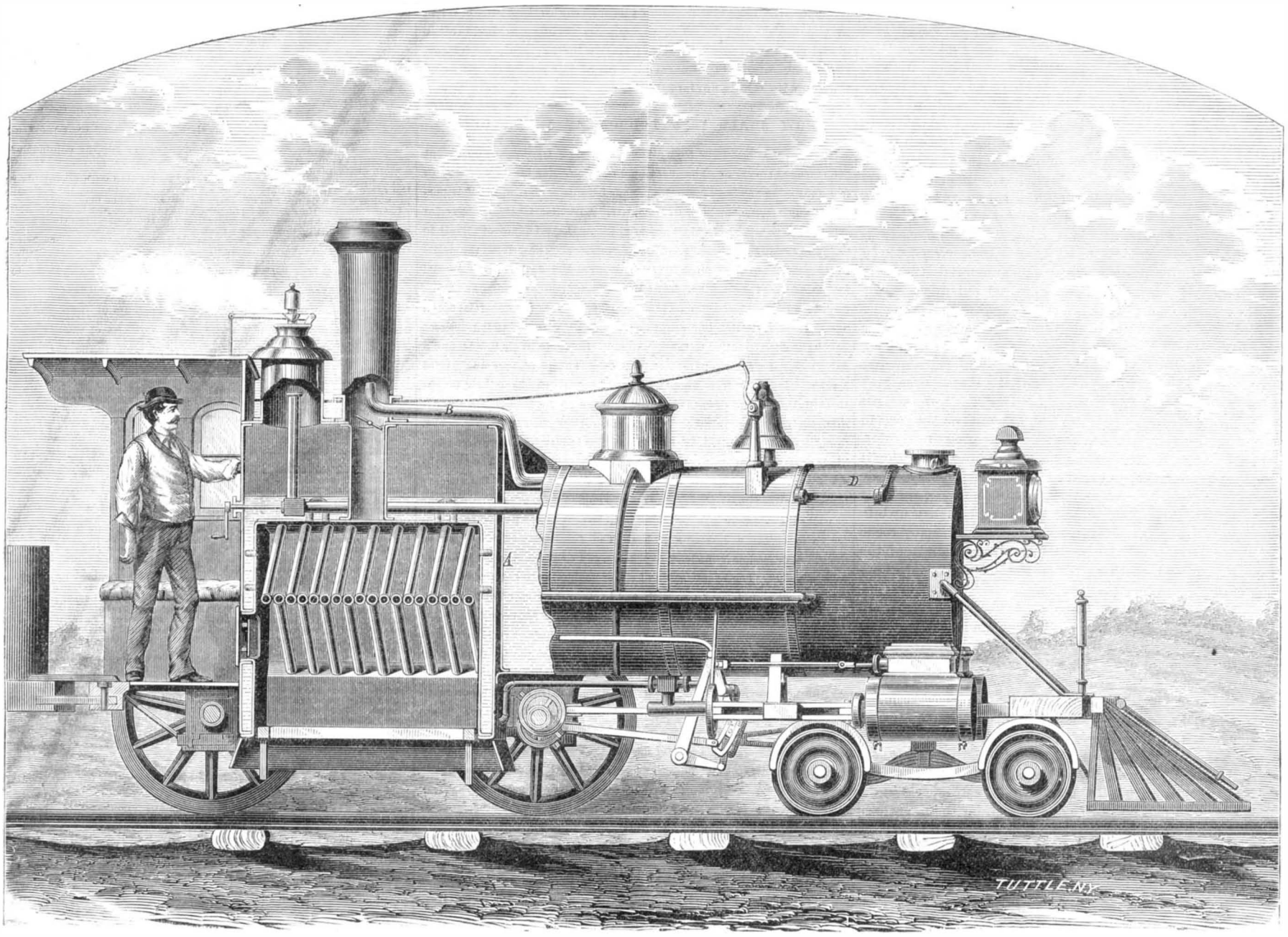
CASEMENT'S IMPROVED METHOD OF BURNING FUEL.

The improved steam boiler represented in the annexed engravings presents certain novelties in construction, by which it is the object of the inventor to utilize the largest possible portion of the fuel, and, by suitable mechanical means to render available, to the full extent, the heat of the ascending products of combustion. The imperfect utilization of the latter is a prolific source of waste, and for this reason any device which may advance novel and useful ideas for preventing such loss may be considered as of important economical advantage.

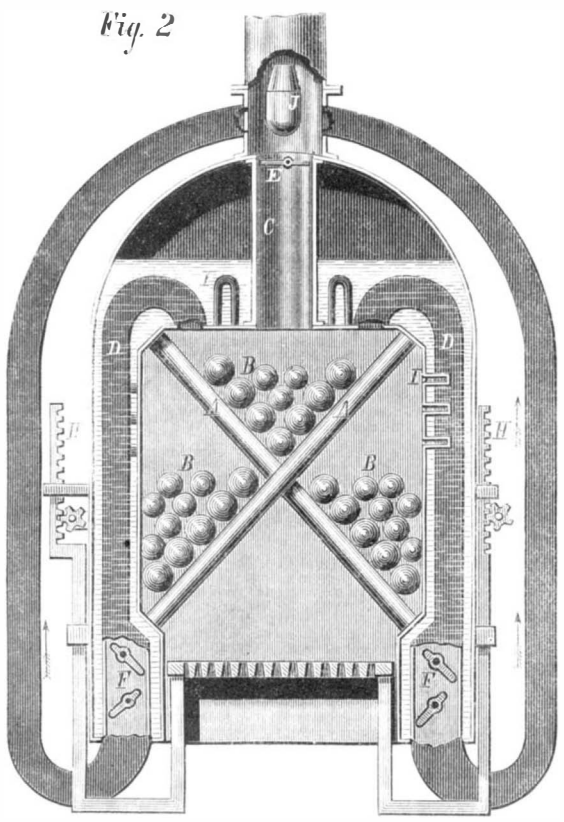
The inventor proposes to conduct the products of combustion, rising from the fire, between and around a number of balls or blocks of metal or other material; so that, the latter being intensely heated, the smoke, gases, etc., coming in contact with them, become entirely consumed. These balls are suitably disposed directly in the upper portion of the fire box, and in such manner as not to obstruct the draft which passes through their interstices. In the same proportion that they improve the combustion, they take up the greater heat produced thereby; and preventing the same from escaping by the flues, hold it, as the inventor claims, so that it is utilized by radiation, thus augmenting the power of the furnaces.

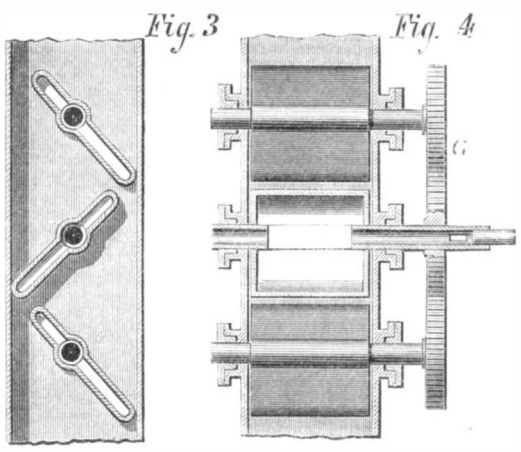
The principle upon which the invention is constructed is practically applicable to ordinary heating furnaces, stoves, or grates, and, as the inventor assures us, for any variety of fuel. The heat, it is asserted, absorbed and radiated by the balls, tends to increase the heat given off by the apparatus, while, at the same time, the amount of material consumed will be considerably reduced.

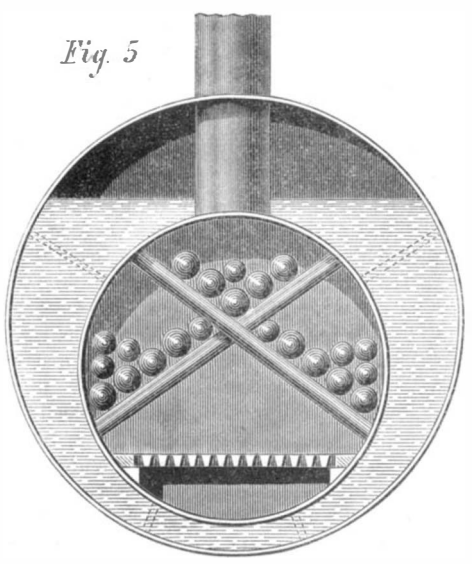
In Figs. 1 and 2 are shown longitudinal and transverse sectional views, from which the construction may be readily understood. Placed diagonally across the fire box, and intersecting each other, are two sets of water tubes, A, Fig. 2, the ends of which are expanded into plates forming the corners of the chamber. These tubes, while largely augmenting the heating surface and improving the circulation of the generator, have for their primary object the support of the balls, B, Fig. 2, which rest upon them. It will be observed that these balls are of varying sizes, the largest being underneath in each tier; by this means, it is believed, the entire substance carried up by the draft will be more effectually divided and brought into contact with the hot metal. C is the direct escape flue, which would, in practice, be used in starting fires, or when a powerful draft was necessary. Ordinarily, however, it is proposed to employ the return flues, D. These open through the crown sheet of the boiler, pass down through the water space, thereby carrying the heat through the cold water near the bottom, thence return upwards and enter the direct flue, C. At E is a damper in the latter, by which its draft may be shut off when the return flues are in action. In order to regulate the draft, and also to take up as much of the escaping heat as possible, a series of hollow dampers, shown at F, in Fig. 2, and in full detail in Figs. 3 and 4, are placed near the lower bend of the flues, D, and in chambers formed in the same. These dampers, which may be of any number, have for their shafts hollow tubes, which, passing through stuffing boxes in the shell, communicate with the water in the boiler, so that the dampers, in fine, being always full, form an additional amount of water



CASEMENT'S IMPROVED STEAM BOILER, LOCOMOTIVE, AND METHOD OF BURNING FUEL.







space. Their location and arrangement, clearly indicated in Fig. 3, show that, when they are fully open, the escaping hot current is compelled to assume a zig-zag course, striking each damper in succession, thus, it is claimed, giving off its heat to the best possible advantage. These gates are connected by gear wheels, G, Fig. 4, so arranged that, by turning one, the motion will be communicated to the others, so that all are operated simultaneously. The grate in Fig. 2 is made vertically adjustable by mechanism which will be comprehended by a glance at the engraving. The racks, H, in the upper portion of the vertical bars of the supporting frame, engage with pinions which are connected by a single crank or similar means. By making the grate so that its distance from the balls may be graduated at will, the inventor states that the intensity of the heat acting upon the latter may be regulated; and in boilers having low fire space, more room can be obtained for the operations of firing, cleaning, etc. At I are shown a number of short return flues or simply sockets let into the walls of the fire box and the crown sheet, in order to increase the heating surface, and at J is the extremity of the exhaust pipe from the engine, the escaping steam from which increases the upward current in

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the uptake. In Fig. 5 is represented the application of a similar arrangement of tubes and balls to the ordinary cylindrical boiler. The construction is quite obvious from the engraving, so that no especial explanation is deemed necessary.

Referring once more to Fig. 1, in that illustration is shown both the improved boiler applied to a locomotive and also a peculiar construction of the latter machine. The form of the generator, it is clearly evident, does not comprise the large cylinder, which forms a part of the ordinary boiler, and the larger portion of the body of the motor; and consequently it is proposed to convert the same into a simple tank completely separated from the boiler by the double partition, A. The object of this is to render the locomotive adjustable in the matter of weight, by filling this receptacle with water or heavy solid material. To illustrate, the inventor considers it unnecessary, and in fact a waste of iron, to run a thirty-five tun locomotive over a road of varying grades, where its full tractile power is needed only on heavy up slopes, while a fifteen tun engine would do all the necessary pulling on levels or down inclines. With a light and compact boiler, with a tank as represented in the locomotive in our engraving, the total weight of the machine need not exceed fifteen tuns; but by filling with water or other material, the same may be quickly increased to any desired extent up to the limit, say of thirty-five tuns. At C, a small funnel is erected which is designed to receive the spout from water stations; and at D a door is placed, which may be used for gaining access to the interior of the tank, or for more conveniently throwing in weights. One or both of these apertures may be employed at will; and by the materials added, the weight of the locomotive may be quickly augmented or lessened in proportion to the load it is to draw and other circumstances. In case of a line having many ascending grades, rendering it necessary to change the weight of the engine quickly, while in motion, it is proposed to place troughs between the rails at the bottom of the slope and let the water be taken up into the tank in the ordinary manner now in use on many roads for filling the tender. On arriving at the summit of the grade, this water is discharged, and the locomotive once more rendered light.

The various parts of the machine, as shown in Fig. 1, are of the usual description and require no explanation. B is the exhaust pipe, to which we have already referred as entering the uptake at J, Fig. 2.

The construction of the boiler and the peculiar arrangement of the locomotive are made the subjects of separate patents, and the credit of the inventions is due to Mr. Daniel T. Casement, of Painesville, Lake county, Ohio, who has patented them, through the Scientific American Patent Agency, in the United States, Canada, England, Australia, and most of the countries of Continental Europe. Letters for further information should be directed, for the next three months, to the patentee, at the Fifth Avenue Hotel, New York city.

Prizes offered by the Paris Society for the Encouragement of National Industry.

In addition to the grand annual medal of commerce, Chaptal prize, a prize of 2,000 francs in the class of cotton industries, the Society offers the following prizes for the year 1874:

	Frs.
For a small motor for home industries	2 000
Combing cotton and short fibers	1,000
Dressing of millstones (Ferté-sous-Jouarre prize)	5,000
Practical and economic production of oxygen	2,000
Utilization of waste matters in factories	1,000
Transformation yielding a natural useful product, such as quinine, sugar, etc	4,000
Artificial production of fatty acids and wax	4,000
Disinfection of the residue of the purification of gas	1,000
Conservation of food in the fresh state	3,000
Apparatus for small workshops producing high temperatures	1,000
Cultivation of grass and trees in mountains	2,000
" " " " (second prize)	500
Irrigation	3,000
" (second prize)	2,000
Production of healthy seed from French silkworms	500
Reclamation of land and embankments	2,000
A drill for sowing manure in powder	1,000
Study of the progression of the phylloxera from one vine to another	2,000
Fabrication of good photographic paper	2,000

Details of these and other prizes to be obtained on application to the secretary, No. 17 Rue de l'Abbaye, Paris.

Bronze Casting under Artificial Pressure.

A French officer, Colonel Lavroff, has given his attention to the casting of bronze guns under a more efficient pressure than has hitherto been employed—a parallel operation with that of Sir Joseph Whitworth in the case of iron and steel.

A cast iron platform is laid on foundation walls; and upon the former rests, first, the ground plate of the mold, and secondly the mold itself, which is of great strength. This mold is surrounded by a heavy cast iron jacket, which is bolted to the platform; springs are arranged to protect the bolts and the other part of the apparatus against the effects of the dilatation of the mold after the running. The cover is furnished with a cylinder formed of clay or other bad conductor of heat, and on this is placed a metallic piston with a pocket or receptacle. The piston and pocket form one solid piece, which is supported in its position at the required level by iron bands. The opening for the metal as well as the pocket is lined with fire clay.

The upper part of the metallic mold and the inferior surface of the cover are also lined with fire clay, in order to retard as much as possible the cooling of the upper part of the casting. The air and gases escape from the mold by means of several conical vents. The apparatus producing the pressure consists of a frame formed of two cast iron cross pieces connected together by means of bolts. This frame, while embracing the mold, is at the same time freely suspended to the chain of a crane by means of an iron ring. The frame is furnished on its under side with a piece of metal, which serves to close the opening through which the metal is run, and to transfer the pressure to the piston. This pressure is produced by means of an hydraulic press fixed to the lower part of the platform, its piston in its descent drawing down the frame.

The conditions laid down by Colonel Lavroff are as follows: (1) Each transversal section of the interior of the mold should be at least equal to any section above it. (2) The upper part of the casting ought to be preserved as much as possible from loss of heat, by means of a non-conducting lining within the mold. (3) Finally, the piston acting on the molten metal should present to it a non-conductor, and, moreover, should act upon the central portion of the liquid column and not over its whole surface.

HOW SHALL I INTRODUCE MY INVENTION?

This inquiry comes to us from all over the land. Our answer is: Adopt such means as every good business man uses in selling his merchandise or in establishing any business. Make your invention known, and if it possesses any merit, somebody will want it. Advertise what you have for sale in such papers as circulate among the largest class of persons likely to be interested in the article. Send illustrated circulars describing the merits of the machine or implement to manufacturers and dealers in the special article, all over the country. The names and addresses of persons in different trades may be obtained from State directories or commercial registers. If the invention is meritorious, and if with its utility it possesses novelty and is attractive to the eye, so much the more likely it is to find a purchaser. Inventors, patentees, and constructors of new and useful machines, implements, and contrivances of novelty can have their inventions illustrated and described in the columns of the SCIENTIFIC AMERICAN. Civil and mechanical engineering enterprises, such as bridges, docks, foundries, rolling mills, architecture, and new industrial enterprises of all kinds possessing interest can find a place in these columns. The publishers are prepared to execute illustrations, in the best style of the engraving art, for this paper only. They may be copied from good photographs or well executed drawings, and artists will be sent to any part of the country to make the necessary sketches. The furnishing of photographs drawings, or models is the least expensive, and we recommend that course as preferable. The examination of either enables us to determine if it is a subject we would like to publish, and to state the cost of engraving in advance of its execution, so that parties may decline the conditions without incurring much expense. The advantage to manufacturers, patentees, and contractors of having their machines, inventions, or engineering works illustrated in a paper of such large circulation as the SCIENTIFIC AMERICAN is obvious. Every issue now exceeds 42,000 and will soon reach 50,000, and the extent of its circulation is limited by no boundary. There is not a country or a large city on the face of the globe where the paper does not circulate. We have the best authority for stating that some of the largest orders for machinery and patented articles from abroad have come to our manufacturers through the medium of the SCIENTIFIC AMERICAN, the parties ordering having seen the article illustrated or advertised in these columns. Address

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Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From January 16 to January 19, 1874, inclusive.

CONDENSED MILK.—G. Conklin, New York city.

FILTER.—P. Huerne, San Francisco, Cal.

FOG SIGNAL.—G. C. Pattison, Baltimore, Md.

MAKING LAMPBLACK.—J. Rogers, New York city.

PIPE WRENCH.—J. Austin, New York city.

SHOE TIP.—A Pollok, Washington, D. C.

VENTILATING AND WARMING.—A. G. Myers, New York city.

DECISIONS OF THE COURTS.

Supreme Court of the United States.

BASE BURNING STOVE PATENT.—HAILES & TREADWELL *vs.* VAN WORMER *et al.*

[Appeal from the Circuit Court of the United States for the Northern District of New York.—October Term, 1873.]

A new combination is patentable if it produces a new result, although all the elements were previously known and in use.

But the new results must be something additional to the results which were separately produced complete before by the different parts of the combination; a mere aggregation of those results is not such new result, and does not render a combination legitimate.

A grouping together of devices in which each one produces its customary effect unmodified by the rest, and no more, and in which no result follows the union which was not previously produced by some of the elements, is a mere aggregation, and not a legitimate and patentable combination.

No one can prevent others from using certain specified devices, either singly or together, because he was the first to use them together, unless he thereby produced a new and useful result which was due to the joint action of the constituent parts, and was not merely an aggregate of the effects which were produced by those parts when operating by themselves.

A claim to a combination which is defined to be "substantially as described" is thereby limited to the elements which are described in the specification as composing it.

Mr. Justice Strong delivered the opinion of the court:

The bill of the complainant is founded upon two patents, for alleged improvements in base burning stoves. Of these patents one is a reissue, dated February 3, 1863, and the other is an original, dated August 11, of the same year. The earliest asserts twelve claims, of which the first five only are charged to have been infringed by the defendants, and the second contains six claims, upon the first and second of which alone it is averred there has been any encroachment. The answer of the defendants denies both the novelty and the patentability of the inventions claimed, and it denies also the infringement charged in the bill.

The stove containing the improvements described in the patents held by the complainants, and that manufactured and sold by the defendants, belong alike to a class of stoves long known as "base burners" or self feeders, called such because they have a magazine or reservoir suspended above the fire pot, which may be filled with coal at its upper extremity, and which, when filled, is closed by a cover. The lower end of the reservoir or feeder is left open; and as the coal in the fire pot is consumed, that in the reservoir falls and supplies the place of that consumed, the combustion being only in the fire pot, and not in the reservoir. Many such stoves had been made, and they were well known years before either of the complainants' patents was granted, and it is not claimed that, merely as base burning stoves, they are within the monopoly of the patents. The inventions claimed are alleged improvements in the structure and arrangement of such stoves. They consist in what is described as a new combination of old and known devices, producing a new manufacture—namely, a stove uniting in itself all the advantages of a reservoir stove, and those of a revertible draft stove, which prevents the products of the combustion in the fire pot from passing up around and over the reservoir, thereby heating the fuel therein, so as to expel its gases, and cause their explosion as well as their escape into the apartments where the stove may be placed. All the devices of which the alleged combination is made are confessedly old. No claim is made for any one of them singly, as an independent invention.

It must be conceded that a new combination, if it produces new and useful results, is patentable, though all the constituents of the combination were well known and in common use before the combination was made. But the results must be a product of the combination, and not a mere aggregate of several results each the complete product of one of the combined elements. Combined results are not necessarily a novel result, nor are they an old result obtained in a new and improved manner. Merely bringing old devices into juxtaposition, and there allowing each to work out its own effect without the production of something novel, is not invention. No one by bringing together several old devices without producing a new and useful result, the joint product of the elements of the combination, and something more than an aggregate of old results, can acquire a right to prevent others from using the same devices, either singly or in other combinations, or, even if a new and useful result is obtained, can prevent others from using some of the devices, omitting others in combination.

If, now, we examine the patents held by the complainants, looking first at the objects sought to be obtained by the combinations for which the patents were granted, they are, as described in the specification, first, to prevent the passage of the products of combustion up, around, and over the top of the coal supply reservoir, so as to heat a surrounding jacket thereof; and, secondly, to heat a circulating or ascending body of air by means of radiated heat from the fire pot, and at the same time to heat the base of the stove by means of direct heat circulating through descending flues which lead into the ash pit, or around it, and to the smoke and draft flue. A third avowed object is to secure economy by retarding the fall of the coal into the fire pot from the supply reservoir, and by causing the flame to circulate outside of the contracted discharge of the reservoir, and around the upper edge of the fire pot, and thence to descend around or under the base of the stove in its passage to the smoke and draft flue. Such are the avowed objects of the combinations claimed to have been devised by the patentees, and their effects they assert to be husbanding the radiated heat, and using it for the purpose of warming the upper part of the stove and the room in which it is situated, as well as for heating air for warming rooms above, if desirable, and at the same time so confining the direct fire heat, and keeping it in contact with the base portion of the stove, as to insure warming it to a comfortable degree. A second effect claimed is relief of the incandescent coal from the weight of the body of superincumbent coal, thus preventing the compression of the burning coal in the fire pot, and securing for the flame free expansion, thus enabling it to act with greater heating effect upon the lower portion of the stove in its passage to the smoke and draft flue.

The combination employed to produce these effects consists of the following devices, among others:

1. A flaring fire pot supported by a base, the diameter of the pot being larger at the top than at the bottom.
2. A magazine or reservoir for supplying coal, located over the fire pot, and having its lower end contracted.
3. Revertible passages or flues outside of the pot for the conduct of the products of combustion downward to the base of the stove, and thence to a main draft flue leading thereout.
4. A direct draft for such stoves as are constructed with revertible flues, the direct draft being obtained by a flue passing out above the fire pot, and provided with a damper to be closed after the fuel has been ignited.
5. Openings in the case or exterior of the stove and the insertion of mica therein, for the purpose of illuminating the room in which the stove may be with the light of the burning fuel.

These devices, with others, are brought together, and claimed as a new combination, and several combinations of some of them are also claimed as inventions producing novel and useful results. What those other devices are we need not specify, for it is not shown that they are employed by the defendants.

The stove of the defendants does, however, contain all those mentioned, and contains them in combination. That each of them was an old device, well known, and in public use before the patents of the complainants were granted, is abundantly proved by the evidence submitted. A flaring fire pot, a supply reservoir with its lower extremity of smaller diameter than its upper, revertible flues, a place for flame expansion above the fire pot, the addition of a direct draft for use in igniting the fuel, provided with a damper, and the insertion of mica for illumination openings, were all found in stoves before Hailes and Treadwell claimed to have made their invention. It is true there is a peculiarity in the construction of the lower extremity of the complainants' supply reservoir. It is provided with a circular flange, extending outward and bending downward, so as to fit upon the upper rim of the fire pot, and thus form a closed combustion chamber. This, of course, cuts off communication with the space around the upper part of the reservoir, and confines the flame and other products of combustion within a circular combustion chamber thus formed: leaving no outlet for them except through ear passages into revertible flues. For this device, the peculiar structure of the reservoir, and the formation of the closed expansion chamber, there is no equivalent in the defendants' stove. There is no such closed chamber. The reservoir does not rest on the fire pot. It has no connection with it, or with the sides of the stove. Nor is there any obstacle interposed to the passage of the products of combustion up and around the reservoir when the flue for direct draft is open; and when that flue is closed, the flame is not detained over the burning coal, but the products of combustion pass directly across the edge of the fire pot, and descend along the sides thereof to the interior draft passage. Such an arrangement is not fitted to produce the effects sought and claimed for the complainants' stoves. On the contrary, it plainly excludes them.

There are other differences in the devices used both in the complainant's and the defendant's stoves, which we think are substantial, and not merely formal. The combination claimed by the complainants passes the products of combustion out of the chamber through perforations in the flange or through ears into flues leading downward, but wholly exterior to the fire pot, and not in contact with it. This arrangement makes it possible to introduce external air through perforations in the outer casing of the stove, and allow it, when heated by contact with the fire pot and the descending flues, to escape from the top. Accordingly the outer casing is perforated, and there is no closed magazine around the fire pot. But in the defendant's stove there is no such device, and no such effects are produced. There are no external downward flues separated from the fire pot. The whole space around the magazine and the fire pot is completely inclosed. There is but a single chamber around the reservoir, over the surface of the burning coal, and around the fire pot. Through this chamber the products of combustion pass, either through the direct draft flue, when that is in use, or to the base of the stove, and thence outward. This arrangement also excludes the possibility of an effect claimed for the Hailes and Treadwell invention. It admits of no space around the fire pot to which the external air can have access.

It is not, then, the combination of old devices which the defendants use that Hailes and Treadwell invented. It is not those old devices that produce the new results claimed. The complainant's combination is a different thing. It has a greater number of constituent elements. It consists in the employment of the devices used by the defendants, together with others they do not use, and the result of the entire combination is the production of a stove differing very materially from that of the defendants; and the defendant's combination cannot produce the results claimed for that of the complainants. We have said that the new results claimed, whatever they may be, are not the production of the combined devices common to both stoves. The devices used by the defendants produce no new effects, because used in combination. The space around the fire pot leading to the base doubtless secures the beneficial results long known to follow the use of revertible flues. It may be conceded to be an equivalent for such flues: but the results of its construction are not changed by the fact that a flaring fire pot and a supply reservoir, with a contracted discharge end and openings for illumination, are used in the same stove. It still operates to conduct the products of combustion to the base and into the exit flue. No new operation is given to it by the combination. The same may be said of every other device employed by the defendants, which is also in the complainant's combination. Each produces its appropriate effect unchanged by the others. That effect has no relation to the combination; in no sense can it be called its product. Thus far nothing novel is produced. This, then, is a mere aggregation of devices, not invention, and consequently the use of those devices, either singly or together, can be held to be any infringement of rights belonging to the complainants.

We pass now to consider more in detail the claims in the complainants' patents, which it is alleged the defendants have infringed. The first in the reissued patent, dated February 3, 1863, is unquestionably too broad to be sustained, unless limited to the means described in the specification. So it was doubtless intended by the patentees to be limited, for the claim speaks of the combination claimed "substantially as described," that is, described in the specification. Thus limited, one of its essential elements is a closed combustion chamber over the fire pot, formed by a flange of the reservoir resting on the upper edge of the pot, and provided with perforations or ears connecting with two flues passing downward. This element is indispensable for the purposes asserted in the claim, as well as in the specification. And the peculiar construction of the chamber is more than formal. It is functional. It prevents the passage of the flame and other products of combustion up, around, and over the supply reservoir, which is a leading avowed object of the invention, precisely the improvements patented. But this constituent of the combination the defendants have never used, nor have they used any corresponding device, or device producing the same results.

The second claim is for contracting the discharge end of the coal supply reservoir, expanding the fire pot, and extending the flame passage downward for united operation in a base burning coal supply reservoir stove or furnace, essentially as set forth. The means set forth for extending the flame passage downward are perforations through the flange, forming the lateral boundary of the closed combustion chamber, or ears leading thereout, and close flues extending from the ears or perforations downward at some distance from the fire pot, through a space bounded on one side by the fire pot, and on the other by an outer casing of the stove, perforated for the admission of external air. It might, perhaps, be questioned whether there is any device in the defendant's stove corresponding to this; but, waiving the consideration of that question, it is very evident that the combination of the three devices named is not the work of invention. They have no relation to each other. Neither the form of the feeder nor the shape of the fire pot bears at all upon the direction of the draft passages. There is no novel result flowing from the joint operation of the three devices. The revertible flues have no more to do with a stove supplied by a feeder than they would have with a stove supplied by hand. There is, therefore, nothing in this claim that interferes with what the defendants have done.

An essential element of the combinations mentioned in both the third and fourth claims is the closed combustion chamber, formed in part by a circular flange extending outward and closing on the top of the fire pot, with perforations in it, or ears for connection with the downward flues, or it is those perforations or ears leading out of such a chamber to the descending passages. These devices the defendants do not employ, and they cannot be used in the defendants' stove. There has been, therefore, no infringement of these claims.

The fifth claim is the only remaining one contained in the reissue which the defendants are alleged to have invaded. It is constructing the fire pot of a base burning stove with an imperforated circumference, and in the form of a trumpet mouth at its upper extremity, in combination with descending flame passages, substantially as described, and for the purposes set forth. How in combination? As described in the specification, united by means of perforated flanges or ears of the pot, involving, of course, the presence of a closed combustion chamber constructed substantially as already described. Construing the claim thus, as we think it must be construed, the defendants have been guilty of no infringement.

Passing now to the second patent, issued August 11, 1863, we observe that its first claim was for a combination of the illumination openings, flame expansion chamber, coal supply reservoir, fire pot, descending flue, and draft flue, substantially in the manner and for the purpose described. In the main, this is the same combination as that claimed in the reissued patent we have had under consideration. The only change is the addition of illumination openings. These were a well known device applied to stoves long before either of the patents were granted. They perform no peculiar office in the new combination. They have no possible relation to it. They do not affect, in the slightest degree, the results of that combination, whatever they may be. It is impossible to regard the mere addition of such openings to a stove containing the improvements described in the reissued patent as the formation of a new patentable combination. It is not invention. If, however, it were, the defendants have not trespassed upon it, for of the combination the peculiarly formed close expansion chamber is an essential constituent, and that is not found in the defendants' stove.

Similar remarks might be made respecting the second claim of the patent of August, the only remaining one alleged to have been infringed. All the elements of the combination have not been used by the defendants.

The decree of the circuit court is affirmed.

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Recent American and Foreign Patents.

Improved Thill Tug.

Dewitt C. Bassett, Cambria Mills, Mich.—This invention relates to means for supporting the thills of a vehicle, and furnishing, at the same time, a convenient mode of attachment for the saddle, breeching strap, and girth. The thill tug consists of a two part tube and a tube containing loops for the saddle, breeching, and girth straps arranged loosely thereon.

Improved Asphaltic Cement Tank.

Tobias New, New York city.—This invention relates to the residuum of coal tar, now used for roofing, paving, and vault covers. As soon as sufficiently cool, this residuum is placed usually in barrels, wherein it soon solidifies, and from which it can only be removed by their destruction, while the cooling and reheating impair its quality. The present invention is a tank in which this valuable cement may be offered to the trade with all its original qualities, and without any necessity for the destruction of the package that contains it. The tank or metallic barrel is made airtight, to prevent the evaporation of the valuable adhesive properties of the cement, and, in conjunction with the inner lining, which is a non conductor of heat, to prevent the escape of caloric. The asphaltic cement is drawn from the still into these barrels or packages, which are then transferred to a chamber, kept always at a suitable temperature, and there held in readiness to be supplied to the trade. During transportation from one locality to another, a small fire is maintained in a central furnace, but only sufficient to make up for the heat that will very slowly escape from the airtight and heat-protected package.

Improved Potato Planter.

Jonathan R. Phelps, Chatham, N. Y.—This invention consists of a cutter on a hollow rotating dropping drum at the bottom of the hopper, in such relation with the passage to the dropping tube that the potatoes, settling down upon the disk, through the hole in the hopper, will be cut off in sufficient quantity for the seed of one hill and delivered into the passage to the tube. The invention also consists of a discharger combined with the cutter and the disk, so as to force out any of the cut pieces that may lodge in the throat between the cutter and the disk, and deliver them into the passage to the tube. The invention also consists of a spring pusher, combined with the cutter, to push the cut pieces into the passage.

Improved Washing Machine.

Elbridge Marshall, Toronto, Kan.—The clothes are placed in a box, between a grooved side and a vertical beater, the top closed down, and a sufficient quantity of water added thereto. A lever is then worked up and down, which produces a reciprocating motion of the beater by the action of toggle levers, and thereby the rubbing, pressing, and squeezing of the clothes till they are perfectly cleaned. This machine may also be used for pressing lard, by putting the lard in a bag between the beater and the side, and placing it in an inclined position for the clear lard to run off.

Improved Cotton Bale Tie.

Leopold Weil, 211 West 51st Street, New York city.—This invention consists of one or more transverse slots through the end portions of the band or hoop, through one or more of which slots, in each end portion, a flat metal pin or key is passed, the two end portions being overlapped. In the case of a bale, the key will merely extend along the hoop or band, between the latter and the bale, so as to be secured by the pressure of the bale. The key has a head to prevent it from passing through; and, if needed, it may be bent or indented with a punch, to secure it from working out. The inventor's object is to provide a bale tie of undiminished strength, and to do away with the necessity of making bends in the band to fasten it The invention can also be applied to barrel hoops, etc.

Improved Running Gear for Carriages.

Daniel Hutchinson, of Hannibal, Mo.—The object of this invention is mainly to provide light vehicles with a platform gearing, by which the construction of the sustaining parts can be made lighter, and the upturning of the body of the carriage prevented, as the front wheels are made to turn freely below the same. The invention consists in substituting for the king bolt a disk turning in an outer surrounding sleeve, which carries the front spring of the carriage, and the springs connecting the step brace of the same. The dispensing with the perch and stays equalizes the additional weight of the step brace and disk pivot.

Improved Magazine Fire Arm.

Frank P. Peace, Marysville, and James W. D. Williams, Knoxville Tenn.—This invention consists of a magazine chamber on each side of the barrel, with a transversely reciprocating block behind them for taking the cartridges from said chambers alternately and presenting them to the barrel, also for removing the shells to a discharger. The block is worked by a crank shaft and connecting rod set in motion by a trigger wheel, which is turned far enough each time it is pulled for firing to effect one movement of the block, which brings the cartridge into position just before the hammer falls. The object is to provide a simple and efficient repeating arm, which can be loaded and fired by simply pulling the trigger.

Improved Bed Warmer.

Job Crockett, Portsmouth, ●.—This invention consists of a flat circular metallic bed warmer, to be filled with hot water, which is provided with a screw plug fitting hermetically into a screw seat. The latter is arranged with notches for allowing every drop of water to be extracted from the inside, both plug and seat projecting to the inside of the pan, being flush with the outer surface.

Improved Machine for Sampling Ores and other Material.

John Collom, Idaho Springs, Col. Ter.—This invention consists of a small short spout which is slowly and regularly moved at intervals under the mouth of a spout or trough, through which the substance to be sampled is caused to run, receiving a certain portion of the said substance, and diverting it from the regular course into a sample box. The proportion of the substance taken to the whole mass is determined by the proportion which the said short spout or receiver bears to the length of the circuit it travels, in the greater portion of which it is not passing the spout. The object is to obtain, from crushed ore, grain, and other substances, samples representing an average as to quality, and the proportionate weight.

Improved Railway Switch.

Carl Naucke, Jr., Magdeburg, Germany.—The object of this invention is to provide a switch mechanism, in connection with the common railroad signal switch, by which the correct position of the switch rail may be obtained by the locomotive engineer, even if the switch is wrongly set by accident or mistake, permitting thereby a full control of the switches by the same without slackening speed, and increased safety against accidents arising from misplaced switches. The invention consists in providing the pivoted switch rails with an attachment plate. This connects, by bell crank levers, with a link-shaped pivoted rod, operated and guided in such manner that the attachment plate and switch rails are moved whenever a latch connection of the link-shaped rod with a longitudinal lever rod, which locks into the sliding switch bar, is released by the action of an inclined lever of the locomotive on the roller of a weighted crank of the locking lever rod. The detaching of the lever rod from the sliding bar is thus produced, and the switch rails are thereby carried into position for the train.

Improved Bevel Sawing Machine.

George S. Grier, Milford, Del.—This invention consists in combining a vertically reciprocating saw with a canting frame, rack ring and pinion, and feed table, having arc bars supported in concavities of the uprights, whereby the whole machine is rendered much more convenient, and its products are caused to exhibit a more thorough, workmanlike, and uniform appearance.

Improved Loom Temple.

John C. Thickins, Washington Mills, N. Y.—This invention consists of a wheel for the weighted strap of a loom temple, provided with a ratchet and pawl arranged to allow the wheel to turn freely when the weight goes down. The weight is free to exert all its force without any loss by friction, and the wheel is prevented from turning when the strap is pulled up. By this means the influence of the friction of the strap on the wheel, to the weight for holding the fabric outstretched against the tendency of the tension of the warp to contract it, is increased.

Improved Railway Rail.

George O. Kunkle, Zieglerville, Pa.—The cap rail is so shaped that its head overlaps that of the base rail, passing then along its side, and being curved at the inner corner of the base, so as to slip easily along the base rail, and be easily removed and replaced. The base rail is first placed in position, being produced to correspond with the cap rail, with rounded head and forward projecting lower corner. The cap rail is then placed with its outer edge under the chair recess, and slid along the base rail till the head overlaps the base rail, resting fully thereon. Both the upper and lower rails may be removed and substituted very quickly, and without drawing a spike. The wear is confined almost entirely to the upper rail, which may be made of steel, the lower of iron. A chair may be used on every tie, or on alternate ties, as desired.

Improved Machine for Gumming Saws.

Thomas S. Jackson, La Grange, Tex.—A slotted stand or socket is adjustably connected with the bed plate. This sloted stand resembles the tool socket of a turning lathe, and it is made adjustable in a similar manner. An arm extends horizontally at a right angle from the shank, which latter is placed in the socket stand. To one side of this arm is attached, on a horizontal arbor, a face gear wheel. The emery wheel is made fast on another arbor, which is supported by the arm, and has upon it a pinion with which the gear wheel engages. A rapid revolving motion is given the emery wheel by revolving the gear wheel. The machine may be operated by hand or by motive power, and is made to gum or dress the teeth of a saw without the use of files, and in the most expeditious manner.

Improved Dental Plugger.

George H. Chance, Salem, Oregon.—Heretofore the metal points of the instruments used by dentists in filling teeth with gold have been exclusively of steel. The above inventor uses gold rendered of suitable hardness by alloy. The advantages claimed are prevention of electrical action from the contact of the steel tool and the gold filling. Second, obviating the danger of minute particles of steel remaining in the filling, forming a center of oxidation. Third, in preventing undue force being used, to the detriment of the operation and pain of the patient, the pliability of the gold point being such that it will bend before an excessive blow, while sufficiently hard for all practical purposes.

Improved Inside Blind.

John H. Voorhees, Williamsburgh, N. Y., assignor to Hardy and Voorhees, of same place.—To one end of the shutter roller is attached a pulley around which is passed an endless belt which also passes around a small pulley on the casing, and by means of which the shutter is wound upon and unwound from the roller. The pulley is recessed to receive the spring, which is coiled around the pivot of the roller. The inner end of the spring has an eye formed upon it, which is slipped over a pin attached to the pulley. The outer end of the spring has an eye which connects with a lever, which, by a pin and a series of holes in its arm, may be adjusted as desired. The tension of the spring is regulated by turning the lever around its pivot. The spring is so arranged as to be wound up by the descent of the shutter, and to be fully wound up when the said shutter has been fully lowered. By this arrangement, the spring increases in strength as the shutter descends, so as to be always about equal to the weight to be supported, so as to always balance the said weight, and thus enable the shutter to be raised and lowered with a very slight outlay of power.

Compensating Attachment for Flour Packing Machines.

Lewis Creveling, Akron, O.—This invention consists in the connection of a strong spiral spring with the shaft from which the barrel platform is suspended, and with a hollow cog wheel, which is guided by a projecting rim in the base plate of the casing, and adjusted to any degree of tension of the spring by means of a pinion with check pawl and crank, as required for the different purposes for which the packer is used. The increasing weight of the barrel or sack to be packed will be compensated by the increased tension of the spiral spring on the shaft, so that the process of packing continues uniformly from beginning to end, the platform returning then easily into elevated position for filling the next barrel.

Improved Fountain Ink Pad for Hand Stamps.

Francis J. Coutant, New York city.—In passing up and down through the top of the ink tank, a certain amount of friction is required to keep the ribbon tightly strained across the pad. This is accomplished by means of elastic valves, one of which is stationary. The other is griped between metallic plates, and moved so as to press the valve against the ribbon by means of finger screws, which move in slots in the top of the tank. There is a plate at one end of the tank, through which the screws pass, which plate is forced up and the screws moved laterally by cam levers. Finger screws at the other end are attached to an angle plate, and produce the same result in a different manner. With this fountain pad the quantity of ink carried up by the ribbon is always the same, and cannot be varied except by compressing the ribbon between the valves.

Improved Mitering Machine.

John Henry Rowland, Denver, Col. Ter.—This invention consists of a saw guide and plane guide for controlling the saw and plane in cutting off and smoothing the wood sticks. There are a couple of shifting stops and a scale for a guide, by which to adjust the stops against which the wood pieces are held for sawing bevels of any angle, right or left. The support for said stops is jointed to the saw and plane guide so as to be adjusted around its major axis, and at right angles to the direction in which the shifting stops change the angles of the miters for making the latter splayed.

Improved Bevel Sawing Machine.

George S. Grier, Milford, Del.—This invention consists in a saw beveling machine with a ratchet on each end of the table, the teeth of the two being inclined reversely from the middle; an adjustable frame placed transversely across a sawing machine table; in combining with an adjustable pointer, connected and moving with the table of a stationary scale plate, having a vertical row of notations and a series of notated arc rows. These improvements are specially adapted to facilitate the preparation of ship timber and the cutting of irregular forms.

Improved Grading Attachment for Levels.

Dr. John Thornley, Charlottesville, Va.—This invention is an improvement upon the grading level for which letters patent No. 143,942 were granted to the same inventor, dated October 21, 1873, and it consists in so constructing and arranging the adjusting graduated bar and its sliding extension piece that a single screw secures them in the desired position, either extended or retracted, and whereby they may be locked together at their respective outer and inner ends by a spring and shoulder connection; and in the combination of said adjusting bar with a piece which is hinged to the under side of the level.

Improved Piston Packing.

Andrew J. Isler, Brownsville, Pa.—This invention relates to means whereby wedges may be applied, in a novel and useful manner, to the spring packing of a piston, and to means whereby the screws that fasten the follower to the piston head may be fastened by nuts on the outside, while the heads of the bolts are located on the inside of the piston head.

Improved Wood Stove Heater.

John C. Frazier, West Alexander, Pa.—This invention consists in making a wood stove with an upper and lower division, the former enlarged and projecting over the latter to receive a hot air chamber, which is provided with two registers, one opening into a pipe leading to the room above, while the other opens into the room in which the wood stove is located.

Improved Safety Attachment for Pocket Books.

John Trout, Omaha, Neb.—This invention consists of a long flap a little wider than the length of bank notes, with one or more elastic straps or cords extending across from edge to edge on the inside, and attached at their ends to the edges of the flap to secure the bank notes, which are to be placed under the straps, and then rolled or folded up in the flap. There is also a safety fastening for attaching the book to the clothing, so as to retain it in case of an attempt to pick it out of the pocket. This fastening is a notched stud pin projecting from a base plate, attached to the clothing and passing through a plate on the book, behind which is a spring catch engaging the said notched pin, so as to hold it until released by pushing the catch out of the notch by a thumb bit provided for the purpose. The fastening is also applicable for securing other pocket articles.

Improved Combined Plow, Scraper, and Chopper.

Hezekiah W. Rumfelt, South Point, N. C.—To the beam, a little in front of the standard, is attached a second standard, which carries a scraper for barring off the plants. Suitable gearing on the forward part of the beam rotates a longitudinal shaft which revolves in bearings in arms attached to the beam. To the shaft are attached two knives, the shanks of which are made of such a length that the knives may be in proper position to chop the plants.

Improved Moccasin.

George F. Parker, St. Stephen's, Canada.—The sole piece is made of an elliptical form, and sufficiently wide and long to form a seam with upper and heel piece, which slopes from the leg seam in opposite directions toward heel and toe, and is at some distance above the tread face. The protuberance of seam is brought upon the outside, to make a smooth surface on the inside. The upper of the sole has a tongue and side projections, to and under which is sewn the front piece, the latter being made to overlap the heel piece and rear leg piece to which it is sewn. By constructing the boot of pieces that are thus shaped and fitted together, a very comfortable and durable moccasin is obtained, while the leather can be cut to more advantage and with greater economy.

Improved Band Pulley.

Edwin Sanford, Hartford, Conn.—This invention consists in making the lagging of pulleys of one rubber or leather strap, at intervals and at each end thickened to enter recesses in the rim of the pulley, secured by screws passing up through the wheel rim thereinto, whereby it will be no longer necessary to take down shaft and remove pulley whenever the lagging needs repair or replacement, but simply to unfasten the screws.

Improved Piston Rod Packing.

Charles H. Fuller, Akron, Ohio, assignor to himself and Edmund W. Deacon, of same place.—An outside casing of rubber is surrounded by covering of canvas. A coil of hempen rope is filled with pulverized soapstone, and with a second rope of rubber cloth is wound around a mandrel of wood of the size of the piston rod, alternately, and then surrounded by the casing. The whole is finally cut off square, so as to fill the stuffing box. In this manner the packing is prepared for use, and may be placed around the piston rod by cutting it open longitudinally, either parallel or obliquely with the piston rod. The packing is elastic, and is made to hug the rod by screwing down the gland. The rubber casing keeps the coils in place, and the soap stone, combined with the hemp, prevents friction.

Improved Thill Coupling.

Bernard H. Wessel, Cincinnati, Ohio, assignor to himself and George H. Groot, of same place.—The object of this invention is to facilitate the changing of the shafts of a carriage to pole, and *vice versa*. It consists of a coupling which is attached to the shafts or pole, and applied directly through the axle or by means of clips and clip plate, and held thereon by a screw, or equivalent, together with a rubber cushion. The device also consists in changing the shackle or coupling at the axle, instead of removing the bolt (as is usually done) that passes through the eye of shaft or pole.

Improved Furrow Scraper.

Frederick G. Thurston, New York city, assignor to M. Ma Del Gado and Joaquin Llera, same place.—The scraper plate has its forward edge made straight and beveled to cause it to enter the ground readily. The middle rear part is cut away, to cause the soil taken up by the end parts of said plate to pass into the furrow to be filled. The plate is made of such a length as to cross the furrow and rest upon the ridges at its sides. The soil taken up by the end parts of the plate, encountering upwardly projecting flanges which incline to the rear, passes inwardly, and drops through a notch in the rear part of the plate into the furrow.

Improved Car Coupling.

Harbert K. Forbis, Danville, Ky.—The draw bars hook together side by side. They are fitted at the rear end in a hanger, and secured, by a key, with a strong buffer spring. This hanger is suspended from a strong plate, pivoted to the car bottom to swing laterally, and allow the draw head the necessary sidewise movements. At the front end of this plate is a stud projecting down each side of the draw bar, to insure the alignment of the one with the other, so that the draw bar will not cramp in the hanger when bumping. A cap on either draw bar slides along in front of the hooked end of the draw bar of the other car, and locks the hooks together. A cap is arranged to be forced back by the end of the draw bar when coupling, and forward after the hooks have engaged, by a spring. It has a bend, and is fitted on an inclined rest, so as to slide obliquely against the hook, and be constantly pressed thereon to insure the hooks against working apart, and to prevent rattling. For uncoupling, the caps are drawn back by a cord, which may be conducted to a lever upon the platform.

Improved Stalk Puller.

Cadwallader Heacock, Trinity, Tex.—The wooden handle of the instrument is inserted in eyes in the upper end and middle part of a metallic bar. The upper part of the latter, between the eyes for the handle, has a curve formed in it to serve as a fulcrum. The part of the bar in front of the end of the handle is nearly parallel with the same, and has a fluke formed upon its side, and projecting to the rearward at an acute angle. The adjacent edges of the fluke and body of the bar are beveled upon the lower side, to cause said edges to take a firmer hold upon the stalk to be pulled. The end of the bar forms a hook for throwing the pulled stalks together into windrows. In using the instrument, the fluke is passed around the stalk near the ground, and the instrument is drawn back to bring the said stalk as far as possible into the angle. The bow sliding upon the ground enables this to be done easily. The handle is then pressed downward, and, the bow serving as a fulcrum, the stalk is drawn from the ground.

Improved Station Indicator.

Michael Farnan and Samuel W. McPherson, New York city.—A pawl lever is pivoted between pawls, so that a movement of it in one direction turns one of two rollers, and a movement of it in the other direction turns the other. To this pawl are connected cords which pass through the cars. A belt passes over the rollers, and has marked upon it the names of the stations. By pulling the cord, which connects with a separate indicator in each car, the brakeman may quickly change the name exhibited. A bell is arranged to sound whenever the belt is shifted.

Improved Combined Cultivator, Stalk Cutter, Harrow, and Corn Planter.

Matthew Green, Walker Station, Mo.—This apparatus is used as a cultivator and stalk cutter combined across the rows. The cutters run on each side of the young plants, and throw up the earth to the adjoining rows by the front plows, while the rear plows open the earth between them. The stalk cutters serve for the purpose of cutting the stalks, and also as fenders for protecting the young corn from being loosened by the tearing up of the stalks, and preventing injury by the falling of heavy clods upon them. After the first plowing, the auxiliary front plows are taken off, and placed on the side beams after the rear plows have been taken off, changing both front and rear plows, so as to throw the earth toward the corn, and produce the covering up of the weeds. For harrowing, the plows are taken off, and the ground smoothed for seed planting, each at the proper time.

Improved Spike Auger.

Roland O. Arbour and Joseph Arbour, Baton Rouge, La.—In the center of the auger a longitudinal hole is bored, in the upper part of which is cut a screw thread. A guide, consisting of a straight bar of steel or iron, is made to nicely fit the hole, and is provided with a screw thread to engage with the female screw of the auger. The outer end of this guide is provided with points, which engage with indentations in the head of the spike, previously made with a punch. As the auger is revolved the guide remains stationary, and the auger will screw into it and cut an annular hole around the spike. The points of the guide being embedded in the head of the spike, the auger is pressed against the wood sufficiently to keep the guide in place. When the auger has passed through the plank it is removed, and then the guide is hidden in the auger, and is extracted by applying the end of the punch which acts as a plug wrench on spurs, and turns the guide round and unscrews it, when the operation may be repeated on another spike, and so on until the plank is released. This auger may be made of any size, so as to suit any sized spikes, and is an expeditious way to release the planks from a vessel in case of repairs or for other purposes.

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Business and Personal.

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Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 23 Cornhill, Boston, Ms.

ANSWERS TO CORRESPONDENTS

H. F. C.'s question is incomprehensible.—R. G. M. will find directions for setting a safety valve on p. 363, vol. 29.—C. W. D.'s query as to the ball falling through the earth is answered on p. 107, vol. 30.—F. M. B. should apply to a dealer in mineral specimens.—B. C. will find a recipe for coating plate iron pipe on p. 11, vol. 29.—J. L. C. will find full particulars of the boiler test commission on p. 97, vol. 30.—S. F. B. should apply to the chainmakers mentioned in our article.—S. should consult Crookes and Rohrig's work on the metallurgy of copper.—J. A. B.'s explanation of a snake's movements is the generally received and, doubtless, correct one.—N. E. can tin small pieces of iron wire by the process described on p. 378, vol. 28.—J. M. R. will find an explanation of the mystery of the long and short screw drivers on p. 393, vol. 18.—J. S. can fasten leather to iron by the process described on p. 42, vol. 26.—A. G. can temper mill picks by following the directions on p. 170, vol. 25.—G. H. W. should apply to a lumber dealer. See our advertising columns.—L. H. H. should consult a boiler maker.—W. L. C. will find a description of the manufacture of lamp black by burning mineral gas on p. 21, vol. 28.

F. E. says: I have a brick building, one story high, 14 feet from the floor to the eaves, and 35 feet from the floor to the ridge pole of the roof. It contains one large open space, used for a machine shop, 120 feet long x 70 feet wide, with an iron truss roof. The roof covering is made of 2 inch matched pine plank, nailed tightly together and covered with iron, well painted outside and inside. This roof is perfectly tight in all stormy weather: but in frosty weather I am troubled by its sweating and water dropping down all over my tools, etc. I heat by steam pipes round the room under the benches. The usual temperature is 62°. Can you tell me what to do to stop its sweating? I have tried a dead air space under the roof of 1½ inches, which helped but does not entirely stop it. Would letting the cold air from outside into the dead air space do any good? A. If the 1½ inch air space were enlarged to one foot in depth, and the cold air were admitted to it sparingly, and tempered by admitting also some of the warm air, it would probably remedy the difficulty. At the same time, the inside ceiling that encloses the air space might be of such material and set at such a grade as to catch and carry off any drip that might still be formed on the inside of the roof itself.

J. L. C. asks: 1. In the spring I wish to build a bank wall 150 feet in length and 3 feet high. This wall I wish to make of concrete. What thickness ought the wall to be? A. The thickness of the wall should be about 2 feet at top, increasing to 3 feet at bottom, the wall commenced 3 feet below the level of the ground and carried up 6 feet high, so as to be 3 feet underground to prevent its being disturbed by frost. Fill in behind with loose stone, and provide openings through the wall at the bottom of the bank to discharge the water which may accumulate behind it. 2. Will such a wall stand the cold and frosts of a New England winter? A. Yes, if proper precautions are taken to build it properly; bring out a projection at top of the concrete, to act like a coping. 3. As Portland cement is high in price, would it do to build the body of the wall with a cheaper article, and skin coat with Portland cement? A. No: it will be found that Portland cement is the cheapest, as there will be less required of it. 4. What are the best proportions for the various articles used in making concrete? A. Of Portland cement, one may be used to thirteen of the other ingredients. Take one barrel of the cement to four barrels of clean sharp sand, and fill in with as much gravel, stone chips, and small stones as can be worked into it, when well supplied with water, and have their surfaces coated with the same. 5. After the wall is built, I wish to paint in imitation of granite. Can it be done? A. Paint with a cement wash. 6. What kind of cement, other than Portland, is best to use? A. Rosendale cement is a good article.

T. O. H. asks: If a man has a right to sell a patent plan in a certain county, has he a right to sell to a man who lives in another county? A. Yes.

H. R. asks: 1. What distance will a well proportioned steamboat make, compared with the travel of her wheels at ten miles per hour in dead water? A. Deduct about 10 per cent. 2. Does the same rule apply to steamboats as to a train of railway cars on a dead level? A. No.

A. O. P. says: I recently found, among the entrails of a prairie chicken, a snake nearly two feet in length. I discovered also that the liver of the chicken had been destroyed by being literally cut to pieces. How could the snake in entering the chicken pass through the gizzard? Could the chicken live without a liver? A. We cannot explain the phenomenon from this statement.

D. H. T. asks: How large a piece of soft cast iron, flanged at right angles, would have the same strength as a piece of white oak 3x4 inches square, and of any length? A. Cast iron has nearly twice as great tensile strength as white oak; it offers about ten times as much resistance to a crushing force, and between three and four times as much to a strain applied transversely.

G. F. J. asks: What is the best work on mechanical drawing for a machinist who wishes to begin with first principles? A. "The Practical Draftsman's Text Book of Industrial Design" will be a good book for you to have. 2. What number of wood screws can be cut in one hour by the most improved machinery? A. Will some of our readers who manufacture wood screws answer this?

S. S. S. asks: 1. How can I cut a large glass bottle across the middle? A. Take a good three cornered file, file a circular notch around the middle of bottle: let the notch be at least 1-16th of an inch deep, and, if the glass is very thick, ¼ of an inch. Into this circular notch fasten a soft small lamp wick or thread of tow, well moistened with alcohol, taking care not to wet the surrounding glass surface. Light the thread, which should be large enough to fill the notch and not wound too tight, and while burning revolve the bottle in the hands, taking hold of the ends, and holding it horizontally so as to confine the flame to one particular part. When burnt out, plunge the bottle at once into cold water. If necessary, repeat the heating and cooling suddenly. 2. Will a porous cup made of plaster of Paris be as good for a battery as one made of earthenware? A. No. The plaster will crumble away in time, and is not sufficiently porous.

T. C. asks: What is used for white writing fluid on colored envelopes? A. A solution of oxalic acid, or indeed almost any acid, when used as an ink on blue paper, will appear white by discharging the color of the paper. White crayons are also used for the purpose.

J. P. asks: I. With a propeller 50 feet long, 8 feet beam, with direct acting engine 8x8 inches, fitted with plain slide valve cutting off at a little more than ¾ stroke, and boiler with 200 feet heating surface, 10 feet grate surface, and 200 inches of chimney section, to burn wood: as crew with three arms, of 3 feet diameter and 6 feet pitch, one third out of the water: What speed am I likely to get? A. Probably from 5 to 6 miles an hour. 2. Will the slip of a screw so slightly submerged occasion a great loss of power? A. Yes. In reply to your other questions, we do not think the boiler will give a very satisfactory result.

N. H. asks: 1. How can I cut and polish agate? A. The lapidary's cutting plates are arranged as follows: 1. Soft iron (very thin) with diamond dust in oil; 2, pewter with coarse emery and water; 3, ditto with fine emery and water; 4, wood, with sand and water; 5, pewter, with rottenstone and water; 6, leather with putty powder, slightly wet. 2. How shall I imprint gold lettering on leather book backs? A. Attach gold leaf to the leather with white of egg, and impress the letters on. The letters are made of brass, and should be hot, but not enough to sputter when wetted. Slightly oil the gold and the face of the letter with a greasy rag. 3. Is the so-called poppet valve of a locomotive arranged differently from an ordinary safety valve, other than in being held down by a spring instead of weights? A. The poppet valve is conical, and fits into the aperture, instead of being tight on the face. 4. Where is the Di Cesnola collection of antiquities to be seen? A. At the Metropolitan Museum of Art, in the Kruger Mansion, 40th street, New York city.

R. R. C. asks: What is a good book on railroad construction, from laying out and leveling to putting down the rails, for the use of beginners and students? A. Vose's "Handbook of Railroad Construction" will be useful to you, but you cannot find all in any book. See our advertising columns for booksellers' addresses.

C. C. H. asks: Can I construct a rifle telescope by using one double convex lens of 28 inches focus for object glass, and one double concave of 1 inch focus for the eyepiece? What should be the sizes, respectively, of the two glasses, to insure a clear field of view? A. You can make a Galilean telescope in the way you propose. The field of view, however, in this telescope is not very large. An adjustment is made when a telescope is used with a rifle by raising the end near the eye. For ordinary purposes, as a terrestrial telescope or spy glass, at least 4 or 5 glasses are used, one for the object glass, and the others for the eyepiece. The object glass can only be well made by a skillful optician, so that it would probably be much cheaper for you to buy a small glass than to attempt to make one. For particulars as to the construction of the telescope see any good work on optics.

J. B. P. says: A friend having a threshing machine engine, with hind wheels of 4 feet diameter, wishes to make it a self-propeller. To do this he has taken off one of the 4 feet wheels and substituted an 8 feet driver, connecting to his engine with a chain, running his engine six revolutions to the drive wheels' one. I told him he would get as much power and speed by connecting in the same way on to his 4 feet wheel and running his engine three revolutions to one of the drive wheel. Who is right? A. From the *data* sent, you are right.

W. M. R. asks: Is the common red clover seed used for any purpose besides sowing? I hear that it is used for coloring prints. A. We have never heard of the red clover seed being used for the purpose mentioned.

S. A. T. says: 1. I wish to speak of what I call steam fuel. In the workroom of my factory (20x40 feet) we have a cast iron stove, 20 inches in diameter, in which we keep fire from 8 A. M. until 5 P. M. in the following manner: In the morning, the entire contents of the stove are let down into the ash pan which hangs and projects below the stove body. There is about 1 bucketful. Into the pan is poured enough water, generally 4 quarts, to knead the ashes into a thick dough; afterwards fire is started and the coals are all red hot, which is at 9 A. M. The contents of the ash pan are spread evenly all over the top of the fire. It remains red hot through the entire day; not only the stove gets red hot, but, on taking off the lid of the stove (which opens on top) and looking in, the contents present the appearance of molten iron. This becomes solidified into one cinder, which is lifted out next morning and the ashes under it let down for another dough mixture; there is but one coaling, and that is at 8.15 A. M., the stove throwing out an intense heat for 8 or 10 hours without raking. A stove can be arranged to keep fire for 10 or 12 hours, but then you get no heat. There are evidently 4 quarts of water burnt up in our stove every day. A. This is an interesting account of a system of economical firing which has frequently been recommended. 2. How can I get the tin off tin plate, so that it will hold black asphaltum varnish? I can burn it off, but our "ash dough fire" burns the iron to pieces. A. Cover the tin with a coat of ordinary paint. 3. How can I wash chamois skin which has become dirty, so that it will not be as dry and hard as a board? A. If it is washed perfectly clean, and well rinsed, it will not be hard, when dry. 4. Is there any method by which cheap photography can be accomplished for home amusement? A. You can get apparatus for home use at a moderate price from a manufacturer of photographic materials. 5. I have a sign in my store composed of red letters on blue ground. Every person who looks at it complains of its hurting their eyes, in fact it really does so; and if you look at it steadily for a few seconds, the letters appear to move or dance. A. A combination of red and blue, which are not complementary colors, is an improper arrangement with regard to producing the best effect upon the observer. 6. Some of my workmen have chapped hands, caused by having them wet a great deal and frequently immersed in strong caustic soda water. They crack open and the dirt will get under the skin or in the pores; and, if greased over night, will not wash clean next morning. A. It would be well to protect their hands with waterproof gloves. One of our correspondents recommends dipping the hands in vinegar or vinegar and water to neutralize the alkali. 7. I send a mineral specimen. What is it? A. The mineral sent is a quartz crystal, of no pecuniary value.

B. H. asks: 1. Please give me a good rule for finding the pressure of steam in pounds to the square inch in an engine boiler? A. You can best determine it by a gage. 2. How can I find the horse power of an engine? A. See article on "Indicating Steam Engines," in SCIENTIFIC AMERICAN for January 31, 1874. 3. To what railroad official had I best apply for a situation? A. It depends on the situation you desire. Probably the president would be the proper person to see, if you want a position on the engineer corps; the master mechanic, if you want a position on a locomotive; the superintendent, for appointment as brakeman or conductor and so on.

W. F. W. asks: Does the lever principle apply to a water wheel? For instance, in two overshot wheels, one 10, the other 20 feet in diameter, with buckets of equal size, if one bucket in each wheel be filled, will one give any more power than the other? Does the same principle hold good in turbine wheels? A. The principle of the lever applies in all such cases.

A. S. asks: Can a person obtain instruction in New York on proper use of instruments as used by the United States Signal Service Bureau? If so, where? A. You can obtain rules and instructions from the Bureau. You can obtain the prices of instruments from a reliable maker.

A. H. O. asks: 1. What material is best for an emery belt? A. Leather. 2. Is there anything better than glue to stick the emery on with? A. We think not.

P. H. R. asks: Can a clock be made to run without power from springs or electricity, and without requiring to be wound up, in fact, to receive a steady movement from itself? Is such a thing possible? Is there any company or society in the United States that would support a poor man in experimenting in such work? A. We must answer no to all your questions.

O. P. asks: What is the effect of excessive dampness on masonry constructed with ordinary mortar? My mill is built of brick with stone foundation. At its base in the rear, the stream flows, washing it somewhat, while the dripping from the race above creates some spray and much dampness. Is there any danger of the foundation or wall giving way? If so, what kind of mortar should have been used in the first instance? A. It is quite likely that your foundation is unsafe, but could not answer positively without knowing more particulars. Some kind of hydraulic cement is ordinarily used in such cases.

C. H. asks: Given the size of ports, exhaust and stroke of the valve, how large should the valve be? A. If the valve has no lap, it must be large enough to cover both ports, when in mid position, and the stroke is twice the width of the steam port.

F. C. C. says: 1. If I undertake to carry water in wooden pipes a mile under the ground, how much waste must I allow for absorption, evaporation, etc.? A. It will depend upon the material. You can readily determine the matter by experiment. 2. There is fall enough to throw the water into a tank over a boiler and save the labor of a well pump. How much shall I save by this? A. About twice the theoretical power required to lift the water. 3. What would be the difference in cost between a wood pipe and a cast iron pipe, and which, upon the whole, had I better have? A. The wooden pipe would be much the cheapest in many localities. If you have facilities for making it, we think the wooden one may be the best for you. 4. What is the smallest sized pipe, wood or iron, that I could use, and what is the least fall the water need have? A. You do not send enough *data* for us to answer this question. Your best course would be to have an effective condenser of your steam.

F. G. H. asks: Will a round chimney give a better draft than a square one, if the area and surface presented for friction are the same in both cases? A. In practice there is no essential difference in the draft of the two forms.

L. W. asks: Which is the most economical to heat a tank of water, using live steam or heating pipes in the water? Does it necessitate running the pipe to the bottom if done with live steam? Will not the pipes heat it quicker, and take less steam if there be an outlet into the water or elsewhere? A. The relative economy of the two systems will depend considerably upon the general arrangement.

H. G. B. asks: How can I alloy gold? A. Gold is alloyed with silver or copper, or with both. Melt the gold in a separate crucible: and if copper is to be added, this is also to be melted in another crucible and poured into the gold. To ensure a thorough combination, two red hot crucibles should be used, and the liquefied metals poured alternately from one into the other. To prevent oxidation from the air, put into each crucible a small quantity of a mixture of common salt and charcoal. The metallic alloy should also be occasionally stirred with a rod of pottery ware.

W. H. F. asks: Is the objection to steam propulsion on canals the washing away of the banks? Would a system which would propel the boat without disturbing the water be of any use? A. The difficulty about canal navigation by steam is not the washing of the banks. The trouble is to find a method of slow propulsion by steam that shall be as cheap and easy of management as towage by animals.

R. T. asks: 1. Will a patent be granted to another person on an already patented mixture, if one or more ingredients be added or omitted? A. Not unless there is some essential difference in the compound produced, or in adapting it to another purpose. Merely adding to or taking away from a patented material compounded for a certain purpose, and use without substantially altering it for said purpose and use, is not patentable, unless as an improvement on the prior patent. 2. How is gas lime made? A. Gas lime is simply the refuse lime from the gas purifiers in gas works.

J. H. asks: What is the best method for mixing paints for painting on glass, to stand heat and cold, and to be exposed to all kinds of weather? A. Glass in which the colors are fixed by fluxing certain metallic substances on its surface, and known as "stained glass," is what we would recommend to fulfil the conditions required. This you can buy more cheaply than you can make.

P. C. C. asks: 1. Is it practicable to condense the exhaust of a small compound engine, the steam working 350 feet per minute? A. Yes. 2. Is it practicable to do so in a condenser constructed so that the steam exhausts into gas pipes with cold water running around them? A. This would be the best way of doing it. 3. How will I determine the area of condensing surface, the temperature of cold water, of course, being known? A. In practice, from 2½ to 6 square feet of surface are allowed for each indicated horse power of the engine.

A. C. R. says: How do engravers transfer pictures from paper to wood for re-engraving? A. By first soaking the print in a saturated solution of alcohol and white caustic potash to soften the ink, when the latter will readily transfer to the block under roller pressure. This also answers A. J. P.

A. L. C. asks: Why are objects pictured on the retina of the eye in an inverted position, always seen right side up? A. There are numerous theories. One is that the image formed on the retina of the eye conveys to the mind correct ideas of the relative positions of external objects. Another is that persons judge of the position of an object by the direction in which the rays come to the eyes.

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G. H. M. asks: 1. Do you use a machine to fold your papers as they come from the press? A. Folding attachments for presses have been made, but have not proved successful. The folding is now done on separate machines. 2. What is the capacity of one of your presses? A. The capacity of the presses on which the SCIENTIFIC AMERICAN is printed is about 2,000 copies per hour. 3. Would not a machine to fold papers as they come from the press be desirable? A. Yes, if it could be made to operate without being troublesome.

E. B. asks: Is there a sure test to distinguish genuine butter from the artificial, made in this city? A. It is claimed by the manufacturers that the artificial butter will keep longer without becoming rancid, the readily decomposable compounds not being found in the manufactured article. You might submit the two kinds to a test of this nature.

E. P. asks: How large must be a copper plate for a ground wire be? How deep should it be buried? A. About 2 feet square, placed several feet deep. 2. What is the iron pipe running down to the ground on a fire alarm box for? A. To make connection with the earth.

J. R. M. Jr. asks: In a screw press, with a steel screw, if the screw works in a stationary nut, how much weight would the screw sustain before it would strip the thread or break? A. Multiply the cross section of the cylindrical portion of the screw in inches by the tensile strength of the steel in pounds per square inch. This gives the resistance to breaking. The area of surface resisting stripping in the thread, multiplied by three quarters of the tensile strength in pounds per square inch, gives approximately the resistance to stripping.

W. A. B. asks: Will a common lead pipe, say 1 inch in diameter, having a stream of cold water running through it, melt if exposed to the heat of a blast furnace? I am well aware that a lead pipe without water will melt immediately, but am in doubt about its standing the intense heat if a cold stream is run through it. A. Yes, if the heat is sufficiently intense.

F. M. B. asks: What is the size of the largest steam cylinder ever cast? A. There are engine cylinders 120 inches diameter. 2. If I purchase a patented machine for any particular use, for instance, a blind slat tenoning machine, cutting off and making the tenons on both ends at one operation, do I purchase the machine and right to use it without any reference to the length of time the patent has to run on the machine? Have I the privilege to run it as long as the machine lasts? A. You can use the machine as long as it lasts, unless otherwise agreed.

G. M. asks: What is the greatest number of revolutions that the propeller of a first class ocean steamship makes per minute? Also of a fast going steamship of war? A. Between 50 and 65, in each case.

E. W. B. asks: 1. What do you think of the possibility of making a freight locomotive to run up grades of 75 feet to the mile, with a ratchet wheel working on a third rail, the wheel to be applied to the rail at the pleasure of the engineer? A. This plan is in use in some localities. 2. Can eggs be preserved by placing them in an airtight vessel and exhausting the air, slowly, so as not to break the shells by the pressure outwards, or by separating the whites from the yolks and then exhausting the air? A. We think there are practical difficulties in the way. 3. Can eggs be condensed in the same way that milk is done? A. This is done at present with a fair success.

C. H. M. asks: 1. What are the contents of a ball 7½ inches in diameter? A. 220·89 square inches. 2. Cut this ball through into 15 parts of equal thickness, at or through center of ball; what are the contents of each part? A. For the segments: Let r be the radius of the base and h the hight of the segment: the solidity = $(r^2 \times 3 + h^2) \times 0{\cdot}5236\,h$. For each zone: let r = radius of one base, R = radius of the other, h = hight of the zone; solidity = $(r^2 + R^2 + h^2 \div 3) \times 1{\cdot}5708\,h$. 3. Cut this ball into 15 equal parts (slices); what is the thickness of each part? A. This you can find by trial, substituting values in the preceding formulæ.

T. H. Y. asks: 1. What is a good recipe for killing fleas on a dog? A. Use carbolic soap. 2. How can I destroy garden moles? A. Set traps for them, such as those described in our paper a few months ago.

H. L. says: People say that, if a man be bitten by a dog, he is likely to go mad if the dog is not killed; but if the dog is killed at once, there is no danger. I fail to see why it is of any good to kill the dog, except to prevent his biting any other person. A. We quite agree with you.

J. C. H. asks: 1. How can I back up a mill burr, and what kind of plaster is best? What quantity would I need for a 1½ foot run? A. Make the backing of plaster of Paris. Fill the interstices between the stones with a cement made of powdered alum and powder from burr stone. Some millers adda little molasses. 2. What is the best work on milling? A. Consult the catalogue of a scientific publisher. See our advertising columns.

C. D. asks: Which are considered, in Europe and America, to be the most masterly and thorough works on statics and dynamics? A. Probably Professor Bartlett's work on "Theoretical Mechanics," and Professor Rankine's "Treatise on Applied Mechanics."

F. P. B. asks: Can I revarnish the body of a guitar without injuring its tone? What kind of varnish would be the best? The color of the body is dark. A. We advise you to take it to an instrument maker.

C. E. H. asks: 1. If a boiler has water in and steam up, where is the pressure the greatest, at the top of the boiler over the steam space, or on the bottom under the water? A. Pressure is greatest on the bottom. 2. In reckoning the horse power of an engine, as in your answer to J. W. F., January 31, why do you not make an allowance for friction of the wearing parts, or is there no need of it? A. The calculation was for the indicated horse power, in which no allowance for friction is usual. 3. How long before the SCIENTIFIC AMERICAN is dated is it printed? A. About ten days.

W. I. asks: Is the capacity of a boiler increased by enlarging the steam drum? Is not a steam drum 24 inches in diameter x 8 feet long better than a drum 18 inches in diameter x 4 feet long, for a boiler 40 inches in diameter x 24 feet long? A. The steam room is increased by the change, and frequently this is very desirable.

S. E. D. asks: If we take a quantity of water heated to 100° Fah. and an equal quantity at 40° Fah. and pour them together, is there any actual loss of heat, or is it merely disseminated or distributed throughout the whole quantity? And further, what would be the temperature of the water after being so amalgamated? A. The only loss would be from radiation; and taking no account of this, the temperature of the mixtur would be 70°.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated:

O. R.—Your mineral appears to be a fine Prussian blue.

J. H. S.—Your specimens are iron pyrites, encrusted with a soft bituminous material.

L. L. F.—Your ore is the oxide of iron. If in abundance, it might prove valuable.

H. C.—Your mineral is red jasper, consisting essentially of silica, but containing also alumina and oxide of iron. Some varieties, like the striped and Egyptian jasper, on account of the richness and variety of the colors, are of considerable value for ornamental vases, seals, etc. Jasper is susceptible of a high polish.

B. D. C.—A fine yellowish colored clay. We would advise you to submit it to some potter, who will test it by burning in the kiln. A manufacturer of paints would also inform you of its value as a pigment.

W. L. V.—No. 1 is galena, sulphide of lead, the ordinary ore from which the lead of commerce is extracted. It is frequently argentiferous; but to determine this, a chemical analysis is necessary. No. 2 is blende, sulphide of zinc with quartz, and traces of iron pyrites.

C. T. C.—No. 1 is iron pyrites, sometimes used as a source of sulphur, a valuable mineral when in sufficient quantity near means of transportation. No. 2 is quartz, colored with oxide of iron, of no value.

J. McW.—Your specimen is chlorite with quartz and mica. Chlorite is so named from a Greek word meaning green, on account of its color. It is a silicate of alumina and magnesia with oxide of iron and sometimes lime.

C, J. B.—This specimen consists of galena (sulphide of lead) and blende (sulphide of zinc in quartz), Lyell's "Geology" and Dana's "Mineralogy" are standard works.

J. W.—This mineral is a kind of hornblende, like hypersthene. It yields, by analysis, silica, alumina, magnesia, and lime, and its colors are produced by iron, etc.

G. J.—Red hematite, or red oxide of iron. It contains 70 per cent of metallic iron. It is valuable as a burnisher; the red powder which it gives on pulverizing is valuable as a polishing power, and it is an excellent ore of iron.

E. N. B. asks: 1. What is the tunnage of the United States steamer Swatara? By old measurement she is about 970 tuns. 2. What are the dimensions of the engines of the torpedo boat Alarm and of the United States steamer Gettysburg? What is the length of the latter? 3. What are the lengths and breadths of the frigates Sabine, Saratoga, St. Mary, St. Louis, Dale, and Cyane? 4. What was the speed of the Dictator and Monadnock in their race, in 1865 or thereabouts?—H. W. asks: How can type metal be made black or of any dark color, before japanning?—A. McK. asks: Who was the first inventor of the letter copying press?—E. T. T. asks Where can I find a description of a man hoisting engine for use in mine and other shafts?—D. L. M. asks: If the center core of the centennial tower is perpendicular, and we drop a 1 lb. weight from the south side of its top, where will it strike at the base?—W. G. asks: How can I silver glass globes, etc.? How are different colors produced? Can the silvering be done upon a flat surface with the same effect as on globes?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Car Coupling Dangers. By S. H. D.

On the Moon Question. By M. R.

On the Minerals of South East Missouri. By H. C. T.

On Heating Buildings. By W. H. G.

On a Cure for Rheumatism. By T. C. E.

On the Erie Canal. By J. M. H.

On Preventing Damage from Boiler Explosions. By G. M.

Also enquiries from the following:

C. C. L.—J. S.—R.—W. B.—C. W. Y.—E.—E. B.—H. E. N.—J. W. H—J. H. M.—J. W.—R. T.—R. L. M. A. G. R.—J. S. P.—J. H. A. Jr.—N. R.

Correspondents in different parts of the country ask: Who makes sewage pipe machines? Who makes potato peeling machines? Where can a large aquarium be obtained? Who makes a substitute for India rubber? Who makes four wheeled velocipedes? Who makes the "flying ponies" on which children ride at fairs, etc.? Who sells mulay saw mills? Who makes cooking stoves, heated by kerosene flame? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

January 27, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Well tube filtering point, G. A. Hawley	146,902
Windmill, Crossman & Spicer	146,753

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

28,122.—HOISTING MACHINERY.—R. A. Wilder. April 5.

28,130.—BAKER'S OVEN.—D. McKenzie. April 15.

28,133.—KNITTING MACHINE.—E. Tiffany. April 15.

EXTENSIONS GRANTED.

27,008.—FINISHING BOOT HEELS, ETC.—H. Saloshineky.

27,020.—STEAM ENGINE EXHAUST PIPE.—G. Edwards.

27,023.—CALENDAR CLOCKS.—E. M. & J. E. Mix.

30,467.—SINGEING PIGS.—A. & E. M. Denny.

DESIGNS PATENTED.

7,133.—CURRY COMB.—H. S. Bartholomew, Bristol, Conn.

7,134.—CALL BELL.—N. L. Bradley, West Meriden, Conn.

7,135.—APPLICATION TO ARTICLES OF JEWELRY.—O. P. Coggeshall, Providence, R. I.

7,136.—WATCH MOVEMENT.—A. C. Droz *et al.*, St. Imier Switzerland.

7,137 & 7,138.—CARPETS.—A. Heald, Philadelphia, Pa.

7,139 to 7,141.—SODA WATER APPARATUS.—G. F. Meacham Newton, Mass.

7,142.—CANISTERS.—J. H. Preater, Brooklyn, N. Y.

7,143.—SODA WATER APPARATUS.—M. L. Smith, Detroit Mich.

7,144.—CLOCK CASE.—I. Atkins, Bristol, Conn.

7,145.—TYPES.—A. P. Bauer, Fronkfort-on-the-Main, Ger.

7,146 & 7,147.—TYPES.—J. M. Conner, Greenville, N. Y.

TRADE MARKS REGISTERED.

1,606.—PLOWS.—Carr & Hobson, New York city.

1,607.—MEDICINE.—F. Howard, Newton, N. Y.

1,608 & 1,609.—CLOTHES WRINGERS.—Metropolitan Washing Machine Co., Middlefield, Conn.

1,610.—STEEL PENS.—W. Pedrick, Philadelphia, Pa.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade Mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

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[Specially reported for the Scientific American.]

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, FROM FEBRUARY 4 TO FEBRUARY 10, 1874.

3,084.—L. D. Sawyer, H. P. Coburn and I. Ames, Hamilton, Wentworth county, Ontario, assignees of L. B. Holt, Worcester, Mass., U. S. Improvements in machines for shelling corn, called "Holt and Sawyer Corn Sheller." Feb. 4, 1874.

3,085.—James Foley, Montreal, P. Q. Improvements on machines and process for manufacturing extract of bark for tanning and other purposes, called "Foley's Improved Machine and Process for Making Bark Extract." Feb. 10, 1874.

3,086.—L. W. Pond, Eau Claire, Eau Claire county, Wis., U. S. Improvements on booms, called "Pond's Improved Boom." Feb. 10, 1874.

3,087.—W. Richards, Toronto, Ontario. Machine for cutting open the ends of metallic cans containing oysters or preserved meats and fruit, called "Richards' Can Opener." Feb. 10, 1874.

3,088.—J. P. Manton, Providence, Providence county, R. I., U. S. Improvement on ship's windlass, called "Manton's Ship's Windlass." Feb. 10, 1874.

3,089.—H. H. Robinson, Stanbridge, P. Q. Improvements on those appliances used for preventing horses and cattle from running about, called "Robinson's Safety Yoke." Feb. 10, 1874.

3,090.—G. S. Harwood, Boston, Mass., U. S. Improvements on first breaker feeder for carding machinery, called "Improved First Breaker Feeder." Feb. 10, 1874.

3,091.—P. Hoddy, Waterloo, Ontario. Improvements on coffee roasters, called "Hoddy's Improved Coffee Roaster." Feb. 10, 1874.

3,092.—G. B. Thompson, Boston, Mass., U. S. Improvement on shirt bosoms, called "Thompson's Magic Shirt Bosom." Feb. 10, 1874.

3,093.—A. T. Millar, Ottawa, Ontario, assignee of A. R. Giles, Ottawa, Ontario. Improvements on carriage jack, called "Millar's Improved Wagon Jack." Feb. 10, 1874.

3,094.—H. F. Read, Brooklyn, Kings county, N. Y., U. S. Improvements on water meters, called "The Gem Water Meter." Feb. 10, 1874.

HOW TO OBTAIN

Patents and Caveats

IN CANADA.

PATENTS are now granted to inventors in Canada, without distinction as to the nationality of the applicant. The proceedings to obtain patents in Canada are nearly the same as in the United States. The applicant is required to furnish a model, with specification and drawings in duplicate. It is also necessary for him to sign and make affidavit to the originality of the invention.

The total expense, in ordinary cases, to apply for a Canadian patent, is $75, U. S. currency. This includes the government fees for the first five years, and also our (Munn & Co.'s) charges for preparing drawings, specifications and papers, and attending to the entire business. The holder of the patent is entitled to two extensions of the patent, each for five years, making fifteen years in all.

If the inventor assigns the patent, the assignee enjoys all the rights of the inventor.

A small working model must be furnished, made to any convenient scale. The dimensions of the model should not exceed twelve inches.

If the invention consists of a composition of matter, samples of the composition, and also of the several ingredients, must be furnished.

Persons who desire to apply for patents in Canada are requested to send to us (MUNN & CO.), by express, a model with a description, in their own language, showing the merits and operation of the invention, remitting also the fees as above for such term for the patent as they may elect. We will then immediately prepare the drawings and specification, and send the latter to the applicant for his examination, signature, and affidavit. It requires from four to twelve weeks' time, after completion of the papers, to obtain the decision of the Canadian Patent Office. Remit the fees by check, draft, or Postal order. Do not send the money in the box with model. Give us your name in full, middle name included

Inventions that have already been patented in the United States for not more than one year may also be patented in Canada.

On filing an application for a Canadian patent, the Commissioner causes an examination as to the novelty and utility of the invention. If found lacking in either of these particulars, the application will be rejected, in which case no portion of the fees paid will be returned to the applicant.

Inventors may temporarily secure their improvements in Canada by filing *caveats;* expense thereof, $35 in full.

For further information about Canadian patents, assignments, etc., address

MUNN & CO.,
37 Park Row,
New York.

VALUE OF PATENTS,

And How to Obtain Them.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent, even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN PATENTS

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000, and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, when business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Trademarks.

Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row, New York.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of fomer, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co. 37 Park Row, New York.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co. 37 Park Row, New York.

Design Patents.

Foreign designers and manufacturers, who send goods to this country, may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

A patent for a design may be granted to any person whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto relievo, or bas relief any new and original design for the printing of woolen, silk, cotton, or other fabrics, any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

Design patents are equally as important to citizens as to foreigners. For full particulars send for pamphlet to MUNN & Co., 37 Park Row, New York.

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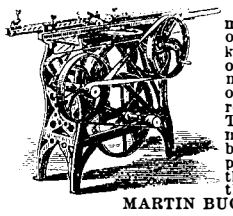

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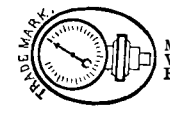

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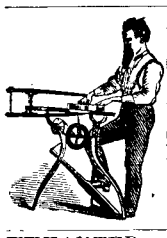

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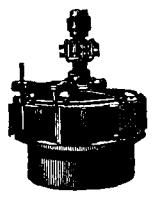

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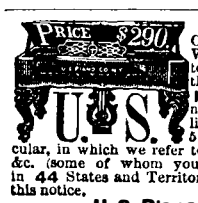

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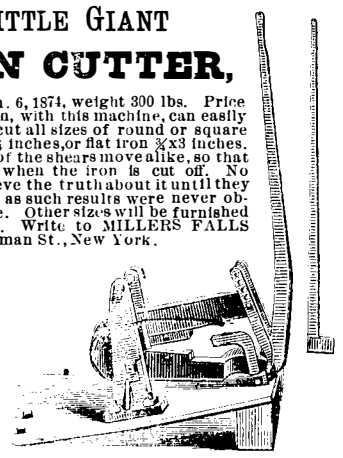

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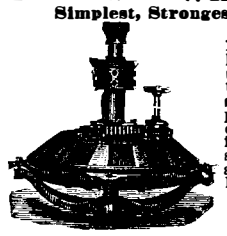

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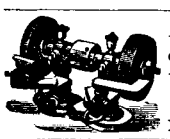

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